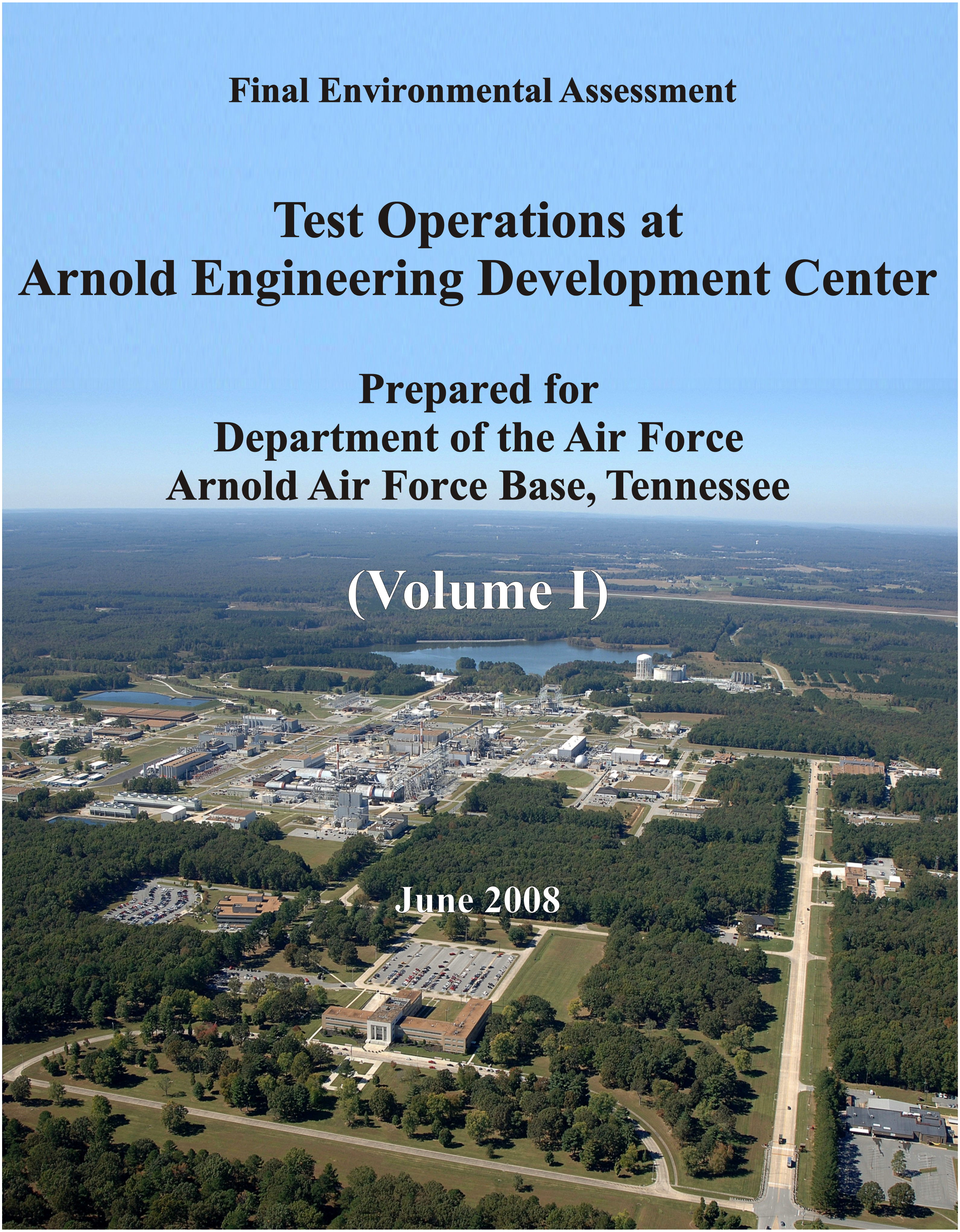
Final Environmental Assessment

Test Operations at Arnold Engineering Development Center

Prepared for Department of the Air Force Arnold Air Force Base, Tennessee

(Volume I)

June 2008



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Finding of No Significant Impact:
Arnold Air Force Base, Tennessee
Test Operations at Arnold Engineering Development Center

Arnold Air Force Base (Arnold AFB) prepared an Environmental Assessment (EA) (June 2008) that evaluated the potential environmental impacts associated with continued testing operations at Arnold Engineering Development Center (AEDC).

Description of the Proposed Action

The Proposed Action is to expand and enhance capabilities at AEDC to meet current and future needs of Air Force Materiel Command's (AFMC) military and commercial clients and other government agencies. Implementation of the Proposed Action is necessary for AEDC to continue to support national air and spacecraft technical superiority.

The goals of the Proposed Action are to increase test operations to fully utilize facility capabilities, while remaining within the permit conditions. In all cases, the limiting condition is associated with the current Title V Air Permit (May 2002). The proposed action includes, but is not limited to:

- Increase the Propulsion Wind Tunnel (PWT) plant operations by a factor of 3 based on the atmospheric air driers Title V air permit limits.
- Increase the von Karman Facility (VKF) plant drier activation heaters to an operational level of 1,920 hours/year.
- Increase the HEAT test assets operation by a factor of 25 with a maximum of 27 hours per year and NOx emissions of less than 20.4 tons/year.
- Limit the Engine Test Facility (ETF) plant test assets to 3,600 hours/year that represents a 49.6% increase from historical values.

The entire operational increases associated with the Proposed Action are described in the attached EA.

No-Action Alternative

The No-Action Alternative would be to continue test operations at the current level with no facility improvement. The No-Action Alternative would not be consistent with the military mission of Arnold AFB.

Environmental Consequences

Under the Proposed Action, test assets at AEDC would operate up to the maximum allowed by the permit conditions for hours of operation or emission discharges. Air emissions would increase but would remain within permit limits and would have no effect on the surrounding environment, as long as AEDC remains in an "attainment" region. Water quality would be unchanged as the vast majority of the discharged water is non-contact cooling water.

Conclusion

The EA was prepared pursuant to 32 Code of Federal Regulations (CFR) 989 and U.S. Council on Environmental Quality (CEQ) regulations (Title 40, U.S. Code, Parts 1500-1508) for implementing the procedural requirements of the National Environmental Policy Act (NEPA). The finding of this EA is that the Proposed Action would have no significant impact on the human or natural environment. Therefore, a Finding of No Significant Impact (FONSI) is issued for the Proposed Action and no Environmental Impact Statement (EIS) is required.

Restrictions

No restrictions are necessary for the Proposed Action.

ARTHUR F. HUBER II, Colonel, USAF
Commander

Date: APR 21 2009

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Prepared for
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Arnold Air Force Base, Tennessee

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

Page

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

Page

List of Figures

List of Tables

TABLE OF CONTENTS (continued)

Page

List of Tables (continued)

List of Appendices

List of Acronyms

AAF	Army Air Force
AAFB	Arnold Air Force Base
ACL	Airflow Calibration Laboratory
ACM	Asbestos Containing Material
AEDC	Arnold Engineering Development Center
AF	Air Force
AFB	Air Force Base
AFI	Air Force Instruction
AFMC	Air Force Materiel Command
AICUZ	Air Installation Compatible Use Zone
APTU	Aerodynamic and Propulsion Test Unit
ARPA	Archeological Resources Protection Act of 1979
ARS	Automotive Repair Shop
AST	Aboveground Storage Tank
ASTF	Aeropropulsion System Test Facility
BMP	Best Management Practices
BX	Base Exchange
CAA	Clean Air Act
CAH	Combustion Air Heater
CATEX	Categorical Exclusion
CE	Civil Engineering
CEQ	Council of Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIPP	Cured In Place Pipe
CMS	Corrective Measures Study
CTS	Captive Trajectory Support
CWA	Clean Water Act
CY	Calendar Year
dB	Decibel
dB_a	A-weighted decibel scale
DESC	Defense Energy Support Center
DFSP	Defense Fuel Supply Point
DoD	Department of Defense
DOPAA	Description of Proposed Action and Alternatives
DRMO	Defense Reutilization and Marketing Office
EA	Environmental Assessment
EIAP	Environmental Impact Analysis Process
EIS	Environmental Impact Statement
EMCS	Energy Monitoring and Control System

List of Acronyms (continued)

EO	Executive Order
ECAMP	Environmental Compliance Assessment and Management Program
EPCRA	Emergency Planning and Community Right-to-Know Act
ERP	Environmental Restoration Program
ERPUD	Elk River Public Utilities District
ESA	Endangered Species Act
ETF	Engine Test Facility
FAA	Federal Aviation Administration
FAR	Federal Acquisitions Regulations
FEMA	Federal Emergency Management Agency
FICON	Federal Interagency Committee on Urban Noise
FPA	Focal Plane Array
FWCA	Fish and Wildlife Coordination Act
FONSI	Finding of No Significant Impact
FY	Fiscal Year
HAAS	High Angle-of-Attack System
GPS	Global Positioning System
HAPs	Hazardous Air Pollutants
HAZMAT	Hazardous Materials
HQ	Headquarters
ICBM	Intercontinental Ballistic Missile
ICRMP	Integrated Cultural Resources Management Plan
IMPs	Internal Monitoring Points
IPP	Invasive Pest Plant
IRP	Installation Restoration Program
KJ	Kilojoule
LDN	Day-Night Average Noise Level
LIP	Limited Interruptible Power
LUC	Land Use Control
MCF	Million Cubic Foot
MOA	Memorandum of Agreement
MVA	Megavolt Ampere
MW	Megawatts
NAAQS	National Ambient Air Quality Standard
NACA	National Advisory Committee for Aeronautics
NASA	National Aeronautics and Space Administration
NCGP	No Consumption General Public
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NHPA	National Historic Preservation Act

List of Acronyms (continued)

NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NRM	Natural Resources Manager
NSR	New Source Review
NSRC	National Supersonic Research Center
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated Biphenyls
PES	Plenum Evacuation System
PL	Public Law
PMEL	Precision Measurement Equipment Laboratory
POL	Petroleum, Oil, and Lubricants
PSD	Prevention of Significant Deterioration
PVC	Polyvinyl Chloride
PWT	Propulsion Wind Tunnel
QCM	Quartz Crystal Microbalance
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RO	Reverse Osmosis
ROI	Region of Influence
RTE	Rare, Threatened, or Endangered
SARA	Superfund Amendments and Reauthorization Act
SAW	Surface Acoustic Wave
SHPO	State Historic Preservation Office
SPCC	Spill Prevention Control and Countermeasures
SWPP	Stormwater Pollution Prevention
SWMU	Solid Waste Management Unit
T.C.A.	Tennessee Code Annotated
TDEC	Tennessee Department of Environment and Conservation
TSCA	Toxic Substance Control Act
TVA	Tennessee Valley Authority
TWRA	Tennessee Wildlife Resources Agency
USACE	United States Army Corp of Engineers
USAF	United States Air Force
USC	United States Code
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
UTSI	University of Tennessee Space Institute
UV	Ultraviolet

List of Acronyms (continued)

UXO	Unexploded Ordinance
VFPS	Variable Frequency Power System
VKF	von Karman Gas Dynamics Facility
VPI	Variable Priced Interruptible
WQA	Water Quality Act
WTF	Water Treatment Plant

1.0 PURPOSE AND NEED FOR ACTION

This environmental assessment (EA) evaluates the potential for environmental impacts associated with continued testing operations at the Arnold Air Force Base (AFB), Arnold Engineering Development Center (AEDC) located in Tullahoma, Tennessee. The Proposed Action is to expand and enhance capabilities at AEDC to meet current and future needs of Air Force Materiel Command's (AFMC) military and commercial clients and other government agencies. Implementation of the Proposed Action is necessary for AEDC to continue to support national air and spacecraft technical superiority and to meet the requirements of Public Law (PL) 81-415, Titles I and II: *The Unitary Wind Tunnel Plan Act of 1949* and *The Air Engineering Development Center Act of 1949*.

The National Environmental Policy Act of 1969 (NEPA) [Title 42, United States Code (USC), Section 4321 (42 USC 4321) *et seq*.] requires that federal agencies consider and document the potential environmental effects associated with major federal actions conducted within the United States. Consistent with the Air Force's Environmental Impact Analysis Process (EIAP) [Title 32, Code of Federal Regulations (CFR) Part 989 (32 CFR 989)] and the Council on Environmental Quality (CEQ) regulations (40 CFR 1500 – 1508), the scope of this EA is defined by the range of potential environmental impacts that could result from implementation of the Proposed Action and alternatives. The objective of this EA is to provide decision-makers with sufficient information to determine whether to proceed with the Proposed Action, and whether the associated environmental impacts support a Finding of No Significant Impact (FONSI) or require an Environmental Impact Statement (EIS) prior to implementation of the Proposed Action or an alternative.

The purpose of this EA is to comprehensively address environmental and cumulative impacts from operations falling within the overall scope of the AEDC mission to facilitate continued compliance with the NEPA and its implementing regulations. Subsequent actions at AEDC associated with test operations will be evaluated for environmental impact significance using this EA to serve as the foundation for analysis. Additional EAs may be required for future projects to comply with NEPA requirements and to support effective decision-making.

This document is prepared in accordance with NEPA as implemented by the CEQ regulations (40 CFR 1500-1508) and Air Force implementing regulations (32 CFR 989). The level of analysis is based on the CEQ list of "indicators of significance", including context and intensity considerations (40 CFR 1508.27).

1.1 Background

AEDC occupies approximately 3,700 acres centrally located within the 40,000 acre Arnold AFB, which lies within Coffee and Franklin Counties (Figure 1-1). The base is located in middle Tennessee in a relatively flat area known as "The Barrens," approximately 70 miles southeast of Nashville near Manchester, Tullahoma, and Winchester, Tennessee. The largest community near the installation is Tullahoma, Tennessee, with over 17,900 residents. Arnold AFB is the largest employer in the two-county area with direct employment of approximately 2,790 people and an annual payroll of over $186 million. Approximately 90 percent of the AEDC work force is comprised of private businesses and contract civilians. The remaining 10 percent of the workforce consists of government, military and civilian personnel who manage the Operating Contract, support contracts, and oversee Center operations and maintenance. AEDC is also responsible for creating almost 2,000 secondary jobs in the surrounding area and has an annual estimated total economic impact on the local community of approximately $536 million (AEDC 2005a).

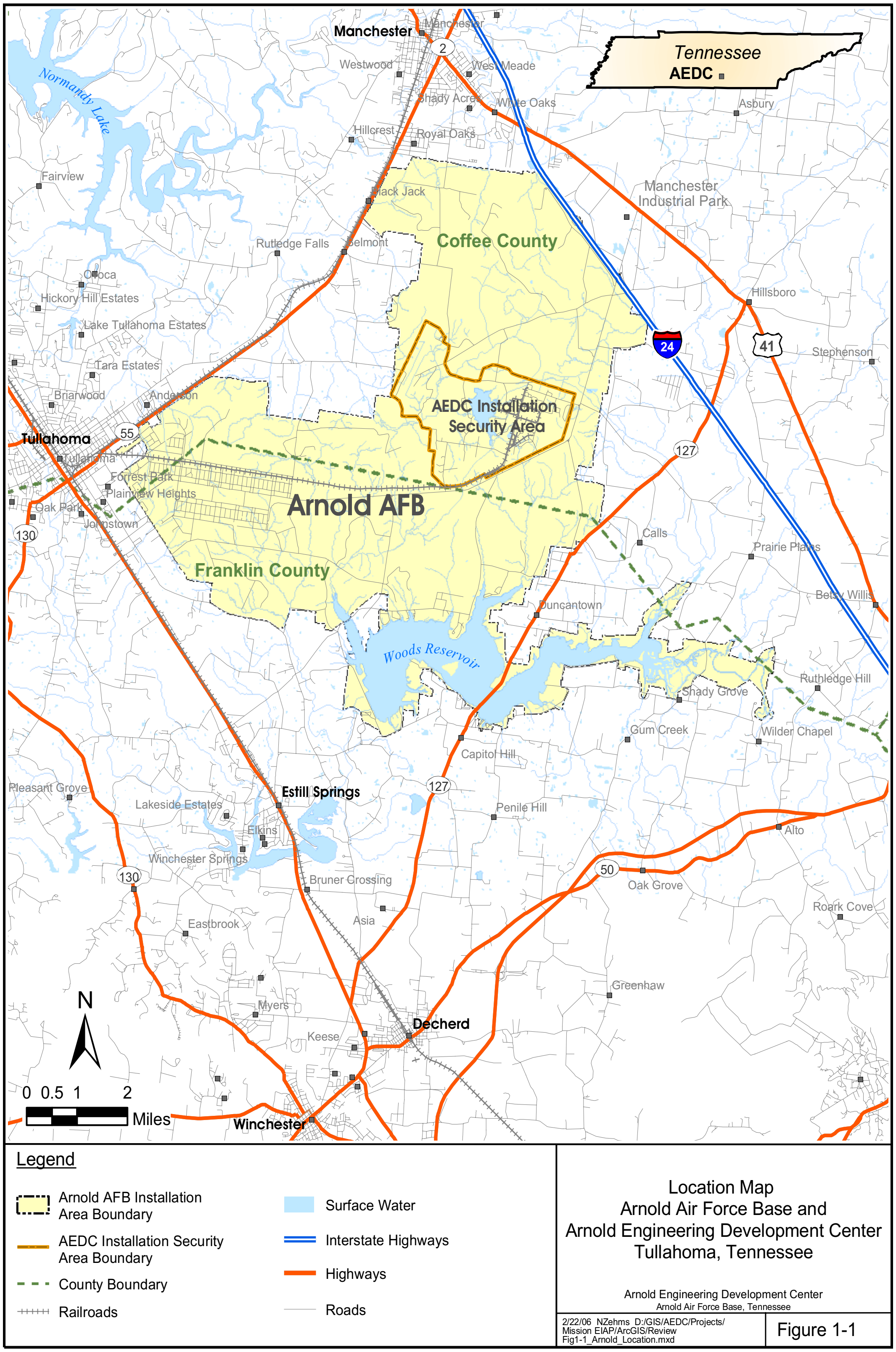


Figure 1-1. Location Map, Arnold Air Force Base and Arnold Engineering Development Center Tullahoma, Tennessee

1.1.1 AEDC Mission

The official AEDC mission statement is "*To provide our customers with the world's most effective and affordable aerospace ground test and evaluation, and simulation products and services. To ensure AEDC ground test facilities, technologies, and knowledge fully support today's and tomorrow's customers*." AEDC is currently the nation's largest and most advanced aerospace, ground test evaluation, and simulation facility, providing the world's most effective aerospace ground test products and services. AEDC forms a significant component of the Department of Defense (DoD) Major Range and Test Facility Base (AEDC 2005a).

AEDC was sited and constructed in response to the passage of PL 81-415, Titles I an II: *The Unitary Wind Tunnel Plan Act of 1949 and The Air Engineering Development Center Act of 1949*. This law directed development of an advanced aerodynamic research center, supporting the national need for a technologically superior military. AEDC and its activities fall under the AFMC. The mission of the AFMC is to deliver war-winning expeditionary capabilities to the warfighter through development and transition of technology, professional acquisition management, exacting test and evaluation, and world-class sustainment of all Air Force weapon systems.

AEDC's primary mission is to conduct tests and simulations for aerodynamics, aeropropulsion, and space and missile systems. The Center conducts development, certification, and simulated flight testing in support of DoD, commercial and international propulsion, aerodynamic, reentry, trans-atmospheric, and space-flight systems. Test conditions simulate operational conditions through a wide range of temperature, pressure, and air speed conditions. Additionally, research is performed to develop new test capabilities, facilities, and technologies for future simulated flight testing. AEDC's testing capabilities provide the benefits of reduced time, risk, and costs associated with system development and provide extensive diagnostic capacity for problem solving.

AEDC's services are used for research, system development, and operational programs for the U.S. Air Force (USAF), the broader DoD, other government agencies, and commercial enterprises engaged in commercial and military aerospace systems development. Customers include the USAF, the Army and Navy, the National Aeronautics Space Administration (NASA), the Federal Aviation Administration (FAA), private industry, allied foreign governments, and U.S. Government and educational institutions (AEDC 2005a).

1.1.2 Operations

AEDC operates aerodynamic and propulsion wind tunnels, rocket and turbine engine test cells, space environmental chambers, arc heaters, ballistic ranges, and other specialized units. Facilities can simulate flight conditions from sea level to altitudes of more than 100,000 feet above mean sea level (amsl), and from subsonic velocities to well over Mach 20. AEDC has contributed to the development of virtually all of the nation's top priority aerospace programs including those listed below:

- Atlas, Titan, Minuteman, and Peacekeeper intercontinental ballistic missiles (ICBMs).
- Polaris, Poseidon and Trident submarine launched ballistic missiles, Tomahawk, Air-Launched Cruise Missile; and the Advanced Medium-Range Air-to-Air Missile.
- NASA Projects Mercury, Gemini, Apollo and the Space Shuttle.
- Navstar Global Positioning System (GPS), MAPS, and GOES-M weather satellites.

- The F-35 Joint Strike Fighter, F/A-22 Raptor, A-10 Thunderbolt II, F-14 Tomcat, F-15 Eagle, F-16 Fighting Falcon, F/A-18 Hornet and F/A-18 Super Hornet, F-105 Thunderchief, F-111 Aardvark, F-117A Nighthawk, C-5 Galaxy, C-17 Globemaster III, C-141Starlifter, B-1B Lancer, B-2 Spirit, B-52 Stratofortress, B-58 Hustler, X-15, X-29, X-32 and X-33, X- 35, and XB-70 Valykire aircraft.

Test operations at AEDC are comprised of three primary mission components, flight systems, aeropropulsion systems, and space and missile systems. Three plant assets: the Propulsion Wind Tunnel (PWT), the Engine Test Facility (ETF), and the von Karman Gas Dynamics Facility (VKF) provide process and high pressure air for test operations. Test operations at these facilities are supported by a variety of services including engineering, facility maintenance, test documentation, and analytical laboratory services. Figure 1-2 shows the relationships between individual testing units and facility complexes. Table 1-1 provides the current status of each test unit.

The PWT plant provides support for aerodynamic wind tunnel testing utilizing two 16-ft wind tunnels and one 4-ft tunnel. The 16-ft wind tunnels are used primarily for testing the aerodynamic performance of full-scale engine installations, large aircraft models, large- and full-scale missiles, and store-separation testing. The 4-ft transonic tunnel is used primarily for store-separation testing, but can be used for sting-mounted force and pressure tests of aerodynamic models or dynamic stability testing.

The test assets located within the ETF plant support aircraft, space and missile, and spacecraft propulsion system research and development through simulated flight tests over a wide range of Mach numbers and altitudes. The facilities provide data at precisely controlled conditions required to determine operational characteristics of aeronautical and astronautical propulsion systems. Testing accomplished within the ETF plant includes the evaluation of air-breathing engine performance, engine/inlet dynamics, engine operability transients, engine aeromechanical behavior, engine mission simulations, engine/aircraft inlet and components/missile mission simulation, ice accretion, engine durability or altitude accelerated mission testing, altitude performance, rocket nozzle vectoring and development, stage separation, rocket heat transfer, rocket exhaust plume radiation and gas dynamics, space radiation, high-altitude rocket plume characteristics, rocket vehicle systems operability, air-augmented rocket performance, rocket (solid propellant) performance while spinning, and extreme temperature evaluations of space motor nozzles.

The VKF plant provides high pressure air for support of test operations in a number of wind tunnels, ranges, arcjets, and space and missile chambers. The aerodynamic test units and associated equipment allow testing of relatively large-scale models of high-speed aircraft, missiles, and spacecraft in a Mach number range from 1.5 to 10. Included in the test units are conventional, continuous-flow tunnels; intermittent blowdown tunnels; continuous-flow arc-heated facilities; and free-flight ranges for both impact and aerodynamic tests of gun-launched models. The space and missile chambers provide for spacecraft testing at all system levels and include sensor calibration and mission simulation, thermal vacuum, radiation effects, and contamination testing. Simulated space conditions include space vacuum and cryogenic temperature, space thermal radiation environment, threat simulations, and vehicle vibration.

Test operation support services include information support software and hardware, and computer-assisted design instrumentation; laboratory services encompassing chemical, metallurgical, and nondestructive x-ray sample analysis in support of testing programs and environmental projects; state-of-the-art machining, welding, sheet metal, and precision measuring capabilities used in the fabrication, refinement, and modification of test models, calibration and thrust measurement devices, and test facilities; photographic, graphic technical documentation, and publication support; security; fire and medical; health and safety; and environmental management.

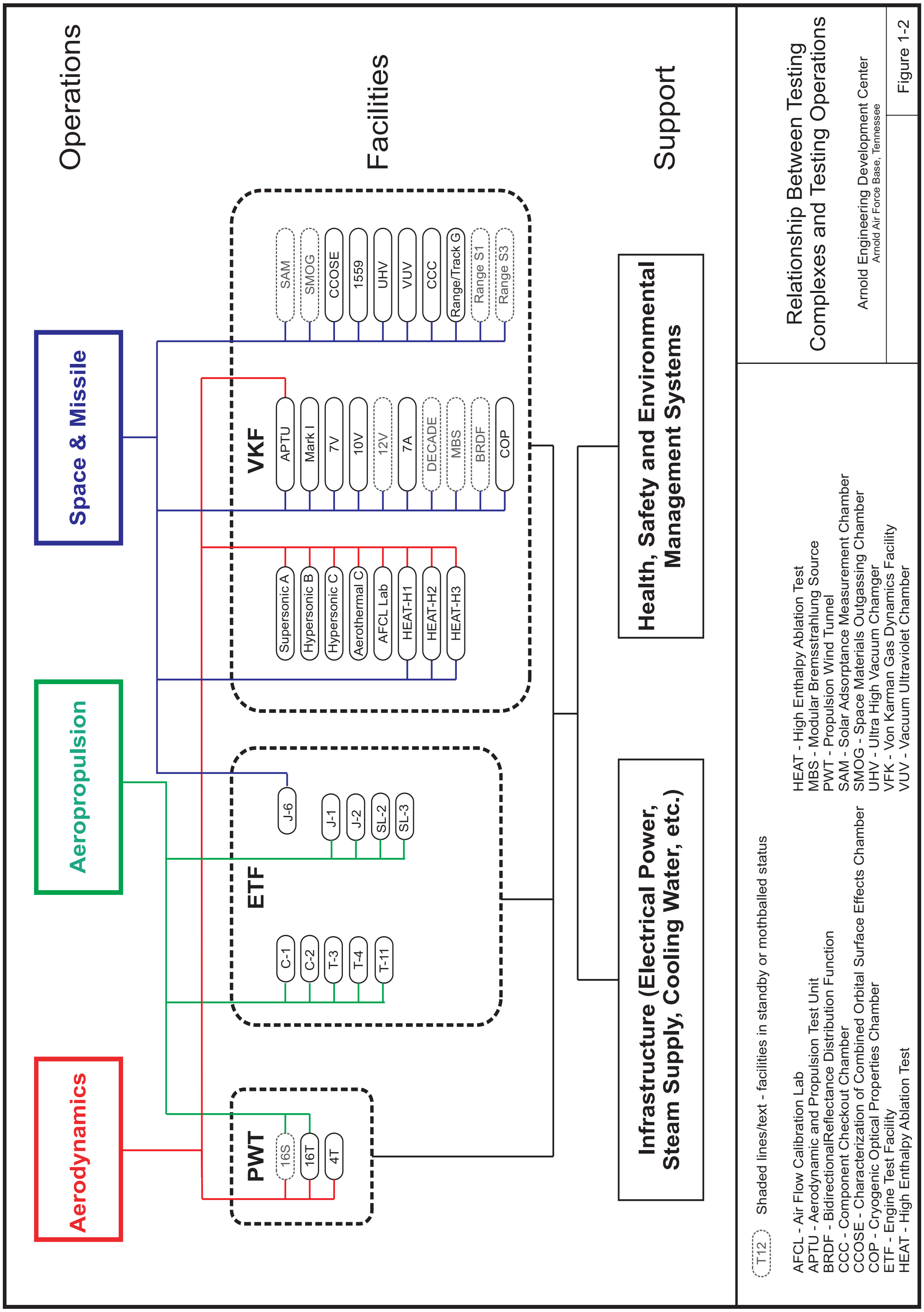


Figure 1-2. Relationship Between Testing Complexes and Testing Operations.

Table 1-1 **Test Facilities and Operational Status**

Test Facility	Testing Operations			Status
	Flight Systems	Aeropropulstion Systems	Space & Missile Systems	
Space Propulsion Test Cells				
J4		•		Abandoned
J5		•		Abandoned
J6		•		Operational
APTU	•		•	In Development
J2A		•		Abandoned
J3		•		Abandoned
Airbreathing Propulsion Altitude Test Cells				
C1		•		Operational
C2		•		Operational
J1		•		Operational
J2		•		Operational
R1A1		•		Abandoned
R1A2		•		Abandoned
R1D		•		Abandoned
R1E		•		Abandoned
R2A2		•		Abandoned
R2H		•		Abandoned
T1		•		Abandoned
T2		•		Abandoned
T3		•		Operational
T4		•		Operational
T5		•		Abandoned
T7		•		Abandoned
T11		•		Operational
T12		•		Abandoned
SL2		•		Operational
SL3		•		Operational
Wind Tunnels				
1T	•			Abandoned
4T	•			Operational
16T	•	•		Operational
16S	•	•		Mothballed
ACL	•		•	Operational
A	•		•	Operational
B	•		•	Operational
C	•		•	Operational
ARCs				
H1			•	Operational

Test Facility	Testing Operations			Status
	Flight Systems	Aeropropulstion Systems	Space & Missile Systems	
H2			•	Operational
H3			•	Operational
Aeroballistic and Impact Ranges				
Range G			•	Standby
Range I			•	Standby
Range S1			•	Standby
Range S3			•	Standby
Space Environmental Chambers				
Mark I			•	Mothballed
7V			•	Operational
10V			•	Operational
12V			•	Standby
CCC			•	Standby
COP			•	Standby
UHV			•	Standby
BRDF			•	Mothballed
VUV			•	Operational
1559 Chamber			•	Operational
7A			•	Standby
CCOSE			•	In Development
SAM			•	Mothballed
SMOG			•	Mothballed
SCMS			•	Mothballed
Nuclear Weapons Effect Facilities				
DECADE - Brems			•	Abandoned
DECADE - PRS			•	Abandoned
MBS			•	Standby

Legend:

Abandoned Test capabilities of the test unit for which maintenance, investment and sustainment efforts have effectively been eliminated. The test unit may have been removed.

In Development A test unit that has an active project underway to either upgrade or restore the unit to a operational status by an established date

Operational Active test unit, either fully or partially mission capable, with a qualified workforce.

Mothballed An inactive test unit, minimally maintained, that could be missing key supporting systems but can be returned to an operational status in generally four to twelve months

Standby A test unit that is used intermittently and maintained sufficiently to return to an operational status in generally one to four months.

1.1.3 History

German aeronautical advances in World War II were of concern to the United States because their weapons clearly demonstrated superior aerodynamic and propulsion advances developed in their apparently superior aeronautical test facilities. U.S. aircraft development during World War II focused on mass production of fairly conventional aircraft, rather than making jet propulsion a national priority. This approach of dominance by overwhelming production was successful, but the technological advances from German research were worrisome. Cognizant military personnel realized that the next war could not be won by sheer weight of production. No option existed but increased technological sophistication, especially in the high-speed aerodynamics and propulsion necessary for jet engine and rocket design (Hiebert 2002).

As early as 1938, General Henry "Hap" Arnold recognized this technological gap and tried to develop advanced testing facilities at Wright Field, then the principal technical center for the Army Air Forces (AAF). His proposals provoked objections from other agencies, including the National Advisory Committee for Aeronautics (NACA), and General Arnold's attempts to advance our propulsion technology failed. General Arnold continued to press for jet engine research, but research into jet propulsion was not a national priority (Hiebert 2002).

At the close of the war, General Arnold directed that items of captured enemy equipment be collected methodically so that technical experts could study the equipment. Captured equipment demonstrated the German lead and heightened concern over American focus on production rather than innovation. The initial push was to transport and install or copy German test facilities and to use German scientists to run them. By 1946, the military was pushing for its own test facility, the Air Engineering Development Center, while the NACA pushed for a National Supersonic Research Center (NSRC). In a compromise effort, the AAF and NACA prepared enabling legislation for presentation to Congress for a Unitary Wind Tunnel Plan with the larger wind tunnels to be shared between the two agencies at the Air Engineering Development Center (Hiebert 2002).

Site evaluation for a potential supersonic research site began in 1946 with consideration of nine general areas of the U.S. These sites were considered for both the Air Engineering Development Center and the NSRC. The initial evaluation recommended Moses Lake, Washington, as the location for the Air Engineering Development Center because of the availability of land, water, power, and buildings, and Camp Forrest, Tennessee, for the NSRC. Moses Lake remained the site of choice for the Air Engineering Development Center until Secretary of the Air Force W. Stuart Symington and Commanding General Carl Spaatz rejected the Moses Lake area because of its strategic vulnerability (Hiebert 2002).

In May 1947, the Research and Development Board approved Sverdrup and Parcel's alternate site, Camp Forrest, for the Air Engineering Development Center. Camp Forrest, a 33,000-acre tract in central Tennessee, had housed 22,000 German prisoners of war (POWs) during the war. The U.S. repatriated these Germans at the same time it was importing German scientists. The Air Engineering Development Center was constructed in central Tennessee with test facilities clustered in the central portion of the base. President Truman signed PL 81-415 in 1949, and personally dedicated AEDC to General Arnold on June 25, 1951, one year after the outbreak of the Korean War and on the birthday anniversary of General Arnold (Hiebert 2002). Table 1-2 shows the early chronology of AEDC.

Table 1-2 Early Chronology of AEDC

1949

August 15 – Maj. Gen. F. O. Carroll named project manager for the Air Engineering Development Center.

October 21 – Congress passes the Unitary Wind Tunnel Plan Act and the AEDC Funding Act.

November 9 – Selection of Camp Forrest, Tennessee, as the site for the Air Engineering Development Center announced.

November 14 – Tullahoma District Office of the Army Corps of Engineers established to start construction of the Air Engineering Development Center.

1950

January 1 – Air Engineering Development Division established as a separate operating agency under the Chief of Staff of the Air Force.

January 3 – First construction directive issued by Air Force to Army Corps of Engineers.

February 28 – Deputy for Material, Air Engineering Development Division, transferred from Washington D.C. to Tullahoma, Tennessee, marking the start of official Air Force activity in Tullahoma.

March 3 – Secretary of Defense approves plans for construction of three major test facilities and support facilities at AEDC.

March 7 – Name of the Air Engineering Development Center changed to Arnold Engineering Development Center in honor of General of the Air Force Henry "Hap" Arnold.

March 21 – Tennessee Governor Gordon Browning signs a construction, survey and exploration permit giving the government right of entry to 33,000 acres of former Camp Forrest land.

March 29 – The Secretary of the Air Force directs that a corporation under contract to the Air Force would operate AEDC.

March 29 – The first contract for AEDC construction of cranes for the Engine Test Facility for $124,000 awarded.

April 19 – Sverdrup & Parcel, Inc. establish ARO Inc., a Tennessee Corporation for managing and operating AEDC.

May 16 – First major construction contract awarded for $207,000.

June 2 – First construction started.

June 23 – Contract to build a dam over the Elk River for $2,863,000 let.

August 11 – German equipment to build the Engine Test Facility transferred to William Northern Field.

September 29 – A contract to build the compressor and drive system for the Propulsion Wind Tunnel facility let to Westinghouse Electric Corp. for $17,649,000.

1951

March 9 – An act of the Tennessee General Assembly turns 34,000 acres of former Camp Forrest land over to the U.S. Government.

June 19 – A letter of contract signed with the University of Tennessee for a university relationships study program.

June 25 – President Harry S. Truman dedicates AEDC.

July 6 – Sverdrup & Parcel, Inc. authorized to proceed with final design of the flexible nozzle of the Propulsion Wind Tunnel transonic circuit.

August 3 – The Air Engineering Development Division redesignated the Arnold Engineering Development Center.

October 25 – The shipping and receiving warehouse transferred to ARO, Inc., the first major construction item to be transferred to the contractor-operator.

1.2 Proposed Action

The Proposed Action is to expand and enhance capabilities at AEDC to meet the current and future test needs for AFMC and their clients. Existing facilities would be operated at full potential within the constraints of the current Title V air permit and National Pollution Discharge Elimination System (NPDES) permit. The Proposed Action includes maximum usage of current facility design features to ensure compliance with all applicable Federal, State, and local environmental laws and regulations.

1.3 Objectives and Need for the Proposed Action

The primary objective of the Proposed Action is to ensure AEDC's continued role in providing test capabilities and research to support national air and spacecraft technological superiority. Continuing in this role requires the ability to operate existing systems and develop new capabilities as needed to ground test full-size rocket and air-breathing engines and appropriately sized models at conditions simulating mission environments from sea level to near space conditions. Additionally, advanced testing facilities are required to support U.S. civilian aircraft technological advancement, including advances in efficiency, materials, and performance, to ensure a viable domestic aircraft industry.

AEDC was sited and constructed in response to the passage of PL 81-415, which directed development of an advanced aerodynamic research center to support the national need for a technologically superior military. The Center's continued operation and ongoing ability to change in response to emerging technologies and customer needs is necessary to support AFMC's mission and facilitate continued compliance with PL 81-415 and governing policies regarding military superiority and national security.

Failure to implement the Proposed Action could reduce, over time, the ability of AEDC and the AFMC to support its mission of advancing the use of technology to maintain and advance the technologically superior military capabilities of the country. A reduction in the ability to ground test emerging technologies and products could result in an increased need for flight testing, which could in turn result in an increased risk to human life and property. The future development of new systems and capabilities could be hampered or rendered infeasible because certain technology advancements and systems development would be impracticable without adequate ground testing capabilities.

1.4 Scope and Approach

This EA evaluates direct and indirect environmental impacts associated with current and future test operations at AEDC, focusing on system inputs and outputs. System inputs include natural resources, utilities, and materials. System outputs include air emissions, water discharges, waste and noise (Figure 1-3).

In addition to the Proposed Action, the No Action alternative is evaluated in detail in this EA. Under the No Action alternative, testing operations would continue at the current level with no facility improvement.

Elements common to the Proposed Action and No Action alternative including current testing operations, infrastructure, and management systems are presented jointly in Sections 2.1, 2.2, and 2.3, with differentiating elements presented in Section 2.6. Likewise, potential environmental consequences common to the Proposed Action and No Action alternative for current operations are presented in Section 4.1, with differentiating impacts for future operations presented in Section 4.2. The analysis of environmental impacts for current operations is based primarily on data for 2000 through 2005, including available operational and environmental data.

This document was prepared in accordance with the requirements of the NEPA of 1969, the CEQ regulations, and the USAF EIAP.

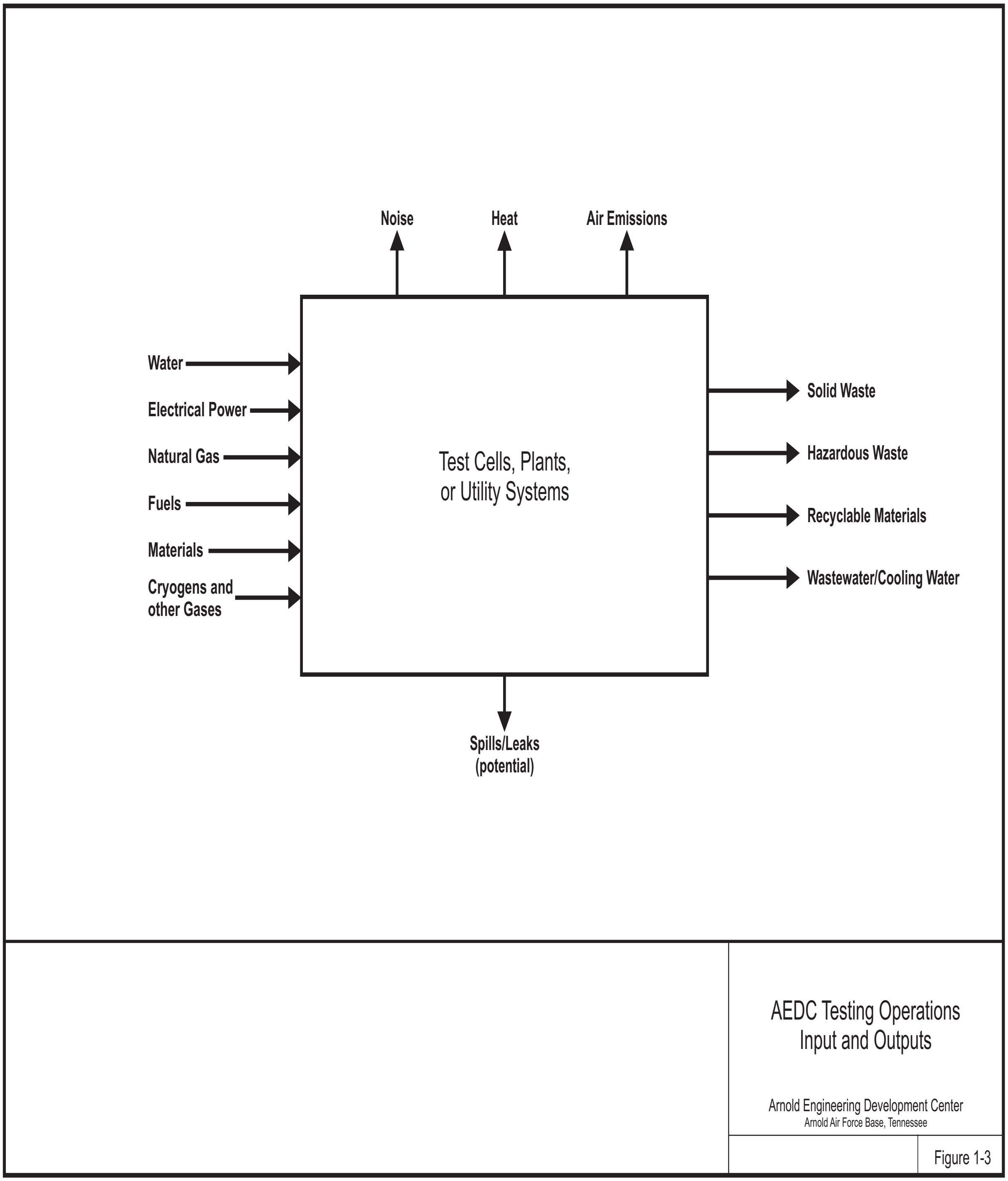


Figure 1-3. AEDC Testing Operations Input and Outputs

1.4.1 Issues Eliminated from Detailed Analysis

Neither the Proposed Action nor the No Action alternative have the potential for adverse impacts on specific resources at the AEDC complex or Arnold AFB. The elements identified below have been eliminated from detailed analysis in this document.

Geology

No activities conducted under the Proposed Action would affect the underlying geologic features of Arnold AFB.

Geomorphology

The Proposed Action would not affect any landforms, slopes, topography or soils. Therefore, geomorphologic impacts are not considered in this EA.

Socioeconomic

Neither the Proposed Action or the No Action alternative will have a significant impact on area employment, environmental justice, or demographics.

Cultural Resources

The Proposed Action will involve land which has already been surveyed and cleared of cultural resource issues. Neither action involves demolition or modification of any potentially historic structures.

Land use

No changes in land use are anticipated from the Proposed Action or the No Action alternative.

Wild and Scenic Rivers

No designated wild and scenic rivers or rivers potentially eligible for listing are present on Arnold AFB or within the region influenced by the AEDC complex.

Radon

The Proposed Action would not include any lodgings subject to radon abatement/mitigation requirements. Therefore, impacts from radon are not expected and are not analyzed in this EA.

Medical and Biohazardous Waste

Medical and biohazardous is not known to have been disposed onsite, and none would be disposed under the Proposed Action or No Action alternatives.

Transportation

No changes in traffic loads or patterns are expected from the Proposed Action.

1.4.2 Issues Studied in Detail

The elements evaluated in detail in this EA are listed below.

- Hydrology, including surface water, groundwater, and wetlands.
- Air, including climate and air quality.
- Biological resources, including wildlife species, plant species, rare, threatened and endangered species, and sensitive environments.
- Occupational health and safety, including noise.
- Hazardous materials and waste.

1.5 Related Environmental Documents

This EA builds upon NEPA documentation relevant to testing operations and infrastructure completed in previous years. These documents are presented in Appendix B with a summary of each including the proposed action, alternatives considered, affected environment, and any mitigation measures implemented. Given the broad scope of this EA, numerous relevant operational and environmental documents were required its preparation. A complete listing of direct and indirect references is provided in Section 6.0. Recent environmental documents of particular importance because of information used or their role in providing relevant additional detail beyond the immediate scope of this EA are listed below.

- *Integrated Ecosystem Management Plan, Arnold Engineering Development Center, Arnold Air Force Base, Tennessee*, Geoff Call, September 2003 (Call 2003)
- *Final Environmental Assessment: Proposed Fiscal Year 2004 Harvest of Pine and Hardwood Pulpwood/Sawtimber, Arnold AFB, Tennessee* (CH2M HILL 2004a)
- *Final Environmental Assessment: Invasive Pest Plant Management*, *Arnold Air Force Base, Tennessee*, CH2M HILL, January 2005 (CH2M HILL 2005a)
- *Final Environmental Assessment: Evaluation of Prescribed Burning for Ecological Restoration and Forest Management*, *Arnold Air Force Base, Tennessee*, CH2M HILL, January 2005 (CH2M HILL 2005b)
- *Final Environmental Assessment: Conversion of Forest Land to Road Right of Way*, *Arnold Air Force Base, Tennessee*, CH2M HILL, April 2005 (CH2M HILL 2005c)
- *Final Environmental Assessment: Building, Paving, and General Construction*, *Arnold Air Force Base, Tennessee*, CH2M HILL, February 2006 (CH2M HILL 2006a)
- *Final Environmental Assessment: Base-Wide Building Demolition*, *Arnold Air Force Base, Tennessee*,CH2M HILL, February 2006 (CH2M HILL 2006b)

1.6 Decision to Be Made

Under NEPA as implemented by the CEQ regulations (40 CFR 1500-1508) and Air Force implementing regulations, the Air Force must evaluate the environmental consequences of any major agency action. Some types or categories of actions do not either individually or cumulatively present the potential for significant environmental consequences and can be categorically excluded from further evaluation (40 CFR 1507.3 and 1508.4; 32 CFR 989.13). Other actions clearly have the potential to significantly impact the environment and therefore require comprehensive evaluation of environmental consequences in an EIS (40 CFR 1502.1; 32 CFR 989.16 - 989.20). Actions that are neither categorically excluded nor clearly require an EIS are evaluated through preparation of an EA to determine the potential for significant environmental consequences. An EA leads to one of three outcomes:

(1) A decision not to proceed with the action.

(2) A FONSI (40 CFR 1501.4(e) and 1508.13; 32 CFR 15).

(3) A formal decision to proceed with an EIS.

The decision required to be made for this EA is whether AEDC will expand and enhance test asset operations to meet the current and future mission requirements or will only maintain current testing operations.

1.7 Authority, Applicable Regulatory Requirements, and Coordination

Compliance with NEPA includes comprehensive evaluation of applicability of and compliance with other environmental and safety and health laws, regulations, directives, and executive orders. A brief summary of federal and state laws and regulations that may be applicable to the Proposed Action is provided in the following sections.

1.7.1 Environmental Policy

NEPA establishes national policy, sets goals, and provides the means to prevent or eliminate damage to the environment. NEPA procedures ensure that information regarding environmental impacts is available to public officials and citizens before decisions are made on major federal actions that have significant effects. The President's CEQ regulations (40 CFR 1500-1508) implement the procedural provisions of NEPA.

32 CFR 989, *Environmental Impact Analysis Process,* implements the Air Force EIAP and provides procedures for environmental impact analysis both within the United States and abroad. The DoD has also established a policy implementing NEPA [*Environmental Effects in the United States of DoD Actions* (DoD Directive 6050.1)].

Protection and Enhancement of Environmental Quality, Executive Order (EO) 11514 as amended by EO 11991, sets the policy for directing the Federal Government in providing leadership in protecting and enhancing the quality of the nation's environment. This policy also includes the examination of impacts unique to minority and low-income populations as required in *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations* (EO 12898).

1.7.2 Air Quality

The Clean Air Act Amendments of 1990 (CAAA) (42 USC 7401 *et seq.*, as amended) establishes as federal policy the protection and enhancement of the quality of the nation's air resources to protect human health and the environment. The CAAA sets national primary and secondary ambient air quality standards as a framework for air pollution control.

The *Tennessee Air Quality Act* [Tennessee Code Annotated (T.C.A.) (Tennessee Statutory Code), Chapter 1200-3-1] establishes provisions to achieve and maintain levels of air quality protecting human health and safety, and to require the use of all available practicable methods to reduce, prevent, and control air pollution for the protection of the health, safety, and general welfare of the people of the State of Tennessee.

Air Force Instruction (AFI) 32-7040, *Air Quality Compliance,* instructs the Air Force on compliance with the CAAA and federal, state, and local regulations.

1.7.3 Water Quality

The *Federal Water Pollution Control Act Amendments of 1972* [more commonly known as the *Clean Water Act* (CWA)] (33 USC 1251 *et seq*., as amended) establishes as federal policy the protection and enhancement of the quality of the nation's water resources to protect human health and the environment. The CWA establishes the basic structure for regulating discharges of pollutants into the waters of the United States through water quality standards for surface water contaminants. The Act makes it unlawful for any person to discharge any pollutant from a point source into navigable waters unless a permit is obtained in accordance with the provisions of the CWA.

The *Tennessee Water Quality Control Act* (T.C.A. Title 69, Chapter 3) establishes provisions to achieve and maintain levels of water quality protecting human health and safety, and to require the use of all available practicable methods to reduce, prevent, and control water pollution for the protection of the health, safety, and general welfare of the people of the state of Tennessee.

AFI 32 7041, Water Quality Compliance, instructs the Air Force on compliance with the CWA and federal, state, and local regulations.

1.7.4 Storage Tanks

The *Tennessee Underground Storage Tank (UST) Program* (T.C.A., Chapter 1200-1-15) and the *U.S. Environmental Protection Agency (USEPA) UST Program* (40 CFR 280) protect public health and the environment by implementing regulations governing the installation and safe operation of aboveground and underground petroleum storage tank facilities. These regulations establish criteria for designing, constructing, and installing secondary containment and also govern the remediation of petroleum contamination when discovered.

1.7.5 Biological Resources

The *Endangered Species Act* (16 USC 1531-1543) requires federal agencies that authorize, fund, or carry out actions to avoid jeopardizing the continued existence of threatened or endangered species and to avoid destroying or adversely modifying their critical habitat. Federal agencies must evaluate the effects of their actions on threatened or endangered species of fish, wildlife, and plants, and their critical habitats, and take steps to conserve and protect these species. All potentially adverse impacts to threatened and endangered species must be avoided or mitigated.

Other legal requirements for protection of biological resources include the *Fish and Wildlife Coordination Act* (16 USC 661 et seq., as amended), *the Migratory Bird Treaty Act of 1918* (16 USC 701 *et seq*., as amended), and *Protection of Wetlands* (EO 11990). AFI 32-7064, *Integrated Natural Resources Management,* instructs the Air Force on compliance with the ESA and federal, state, and local environmental regulations.

1.7.6 Cultural Resources

The *National Historic Preservation Act of 1966* (NHPA) (16 USC 470 *et seq.*, as amended) requires federal agencies to determine the effect of their actions on cultural resources and take certain steps to ensure these resources are located, identified, evaluated, and protected.

The *Archaeological Resources Protection Act of 1979* (ARPA) (16 USC 470a-11, as amended) protects archeological resources on federal lands. If archaeological resources are discovered that may be disturbed during site activities, the Act requires permits for excavating and removing the resource.

AFI 32-7065, *Cultural Resource Management,* instructs the Air Force on compliance with the NHPA, ARPA, and applicable federal, state, and local regulations.

1.7.7 Noise and Land Use

The *Noise Control Act of 1972* (42 USC 4901, *et. seq*., PL 92-574) establishes a policy to promote an environment free from noise harmful to the health or welfare of people. Federal agencies must also comply with state and local requirements for the control and abatement of environmental noise.

AFI 32-7063, *Air Installation Compatible Use Zone Program* (AICUZ) provides the Air Force with guidance on compliance with applicable federal, state, and local regulations. The AICUZ establishes the basic objective of achieving compatible uses of public and private lands in the vicinity of military airfields by restricting incompatible development based on noise and safety factors. This program describes noise conditions and safety zones on and near the military installation. Under joint use arrangements where the airfield operator elects not to implement AICUZ, a base sites new on-base facilities in accordance with AFI 32-1026, *Planning and Design of Airfields,* and the noise compatibility guidelines in the Federal Acquisitions Regulations (FAR) Part 150.

1.7.8 Environmental and Public Health and Safety

The *Comprehensive Environmental Response, Compensation, and Liability Act* of 1980 (CERCLA), as amended by the *Superfund Amendments and Reauthorization Act* (SARA) (42 USC 9601 *et seq*., as amended), provides for funding, enforcement, response, and liability for the release or threatened release of hazardous substances into the environment.

The Installation Restoration Program (IRP) is a DoD program designed to identify, confirm, quantify, and remediate suspected problems associated with past hazardous material disposal sites on DoD installations. The Defense Environmental Restoration Program (10 USC 2701 *et seq.*) is the legal mandate for the IRP.

The *Resource Conservation and Recovery Act of 1976* (RCRA) (42 U.S.C. 6901, *et seq*., as amended) and the *Toxic Substances Control Act of 1976* (TSCA) (15 U.S.C. 2601, *et seq*., as amended) and other laws and regulations provide requirements for use, handling, transportation, and disposal of other substances and wastes that may pose a threat to human health and the environment.

AFI 32-7020, *Environmental Restoration Program,* instructs the Air Force on compliance with CERCLA and federal, state, and local regulations.

The *Occupational Safety and Health Act of 1970* (29 USC 651, *et seq*., as amended) provides regulations designed to protect the health and safety of employees in the workplace. The program is implemented by the Occupational Safety and Health Administration (OSHA) (29 CFR 1900-2400).

The *Emergency Planning and Community Right-to-Know Act of 1986* (EPCRA, also known as SARA Title III) (42 U.S.C. 11001, *et seq*., as amended) sets forth the requirements for emergency planning, including timely notification and response to a release of hazardous substances.

1.8 Document Organization

The main text of this report consists of the following sections:

Section 1.0, Introduction, presents the purpose, background, scope and approach, and organization of this EA.

Section 2.0, Description of Proposed Action and Alternatives, presents the shared and differentiating elements of the Proposed Action and No Action alternative, alternatives considered but eliminated from further evaluation, and a brief comparison of the Proposed Action and No Action alternative.

Section 3.0, Affected Environment, describes the natural and human environment potentially affected by implementation of the Proposed Action or No Action alternative.

Section 4.0, Environmental Consequences, evaluates the common and differentiating environmental impacts that could result from implementation of the Proposed Action or No Action alternative, including cumulative impacts.

Section 5.0, Plans, Permit, and Management Requirements, summarizes plans, permitting, and management systems that might be required for implementation of the Proposed Action or No Action alternative.

Section 6.0, References and Bibliography, lists the documents and sources used in the preparation of this EA.

Section 7.0, List of Preparers, lists the individuals primarily responsible for preparation of this document.

The main text of this EA is supported in Appendices A through K which include a summary of relevant NEPA documentation, air and water permits, air emissions, water discharges, hazardous materials and waste, and utilities and resources usage.

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

The Proposed Action is to expand and enhance capabilities at AEDC to meet the current and future test needs for AFMC and its clients. Existing facilities would be operated at full potential within the constraints of the current Federal and State regulated permit limits. The Proposed Action includes maximum usage of current facility design features which includes oil/water separators, inverted siphon dams, and a flow-through retention reservoir to ensure compliance with all applicable Federal, State, and local environmental laws and regulations.

Under the No Action alternative, current testing operations would continue at the current average levels with no increase in capabilities. Testing of newly acquired systems could be conducted, but only within the constraints of existing facility operations.

The Proposed Action and the No Action alternative are differentiated by maximum hours of operation of each facility. Common elements include AEDC infrastructure and supporting facilities (Section 2.1), health, safety, and environmental management systems in place at AEDC and Arnold AFB (Section 2.2), test assets (Section 2.3), and plant assets (Section 2.4). Elements specific to the Proposed Action and No Action alternative are presented in Section 2.5.

Section 2.6 provides a brief comparison of the Proposed Action and No Action alternative. The information presented in this section highlights the environmental aspects of testing operations and supporting infrastructure. This information in combination with Section 3, *Affected Environment*, establishes the basis for the assessment of environmental consequences associated with implementation of the Proposed Action and No Action alternative, which is presented in Section 4.

The test assets described in Section 2.3 are listed in Table 1-1 and Figure 2-9. All test assets that are in production or that could be brought back on line in a reasonable time frame (standby or mothballed status) are described regardless of their recent operational history. Test assets with an "abandoned" status are not described since they have either been dismantled, are scheduled to be dismantled, or will require extensive restoration in order to become functional.

2.1 Infrastructure and Support Facilities

Infrastructure and support facilities required for AEDC testing operations include raw and potable water supply, wastewater treatment, electrical power distribution, liquid fuel storage and distribution, natural gas distribution, steam supply, heating and cooling, and communications. Infrastructure elements are addressed in this section proportional to their potential for environmental impact and resource utilization. Support facilities for testing operations include various laboratories, fabrication shops, materials and waste storage facilities, maintenance shops, and engineering and administrative buildings. Facilities directly associated with testing operations are described in Section 2.3.

2.1.1 Water Supply, Treatment, and Discharge

The system for water supply, treatment, and discharge includes the potable water supply, cooling water supply, stormwater drainage system, and sanitary sewer system. Figure 2-1 shows the flow for water supply and discharge.

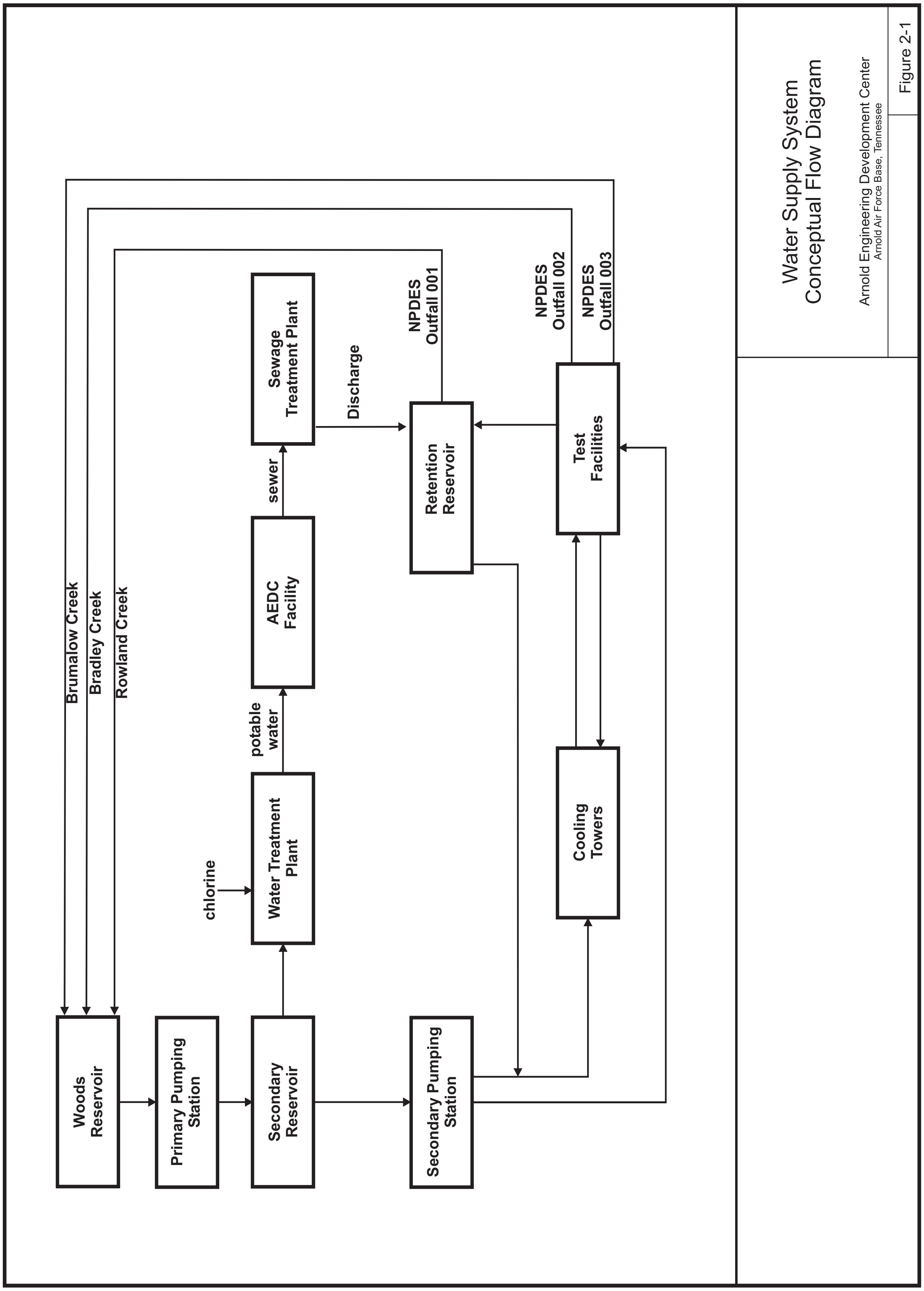


Figure 2-1. Arnold AFB Water Supply System

2.1.1.1 Water Supply

The water supply system consists of two distinct components: (1) the potable water supply system, which provides water for base consumption and fire fighting; and (2) the cooling raw water supply, which supports test facility operations, fire protection at Arnold Village and portions of AEDC, and facility HVAC equipment. Raw water for these systems is pumped from the Primary Pumping Station at Woods Reservoir to the 57 million-gallon secondary reservoir through a 4.5-mile long 60-in. concrete-lined steel water main. Water is transferred to the secondary reservoir at flow rates up to 104,500 gpm utilizing six 2,000-horsepower (hp) vertical turbine pumps. The secondary reservoir supplies the base water treatment plant and cooling water system. Table 2-1 provides the water supply system flow parameters.

Table 2-1. Water Supply System Parameters

Facility	Facility Served	Limitations	Limiting Rates/ Capacity	2004 Annual Rate
Woods Reservoir	All AEDC	PPS rate	26 billion gallons	NA
Primary Pumping Station	Feed Secondary Reservoir	Design rate	104,500 gpm	19.4 billion gallons
Secondary Reservoir	Feed WTP and SPS	Capacity	57 million gallons	NA
Water Treatment Plant	AEDC potable water	Design rate	2.2 mgd	Average 0.8 mgd
Secondary Pumping Station	Cooling water	Design rate	258,000 gpm @ 96 psi	During testing 30 – 120 mgd
Cooling Towers	ASTF, PWT, ETF, Mark I	Design rate	205,000 gpm @ 108 psi	17.3 billion gallons

2.1.1.1.1 Potable Water Supply

Raw water is typically gravity-fed from the secondary reservoir to the base water treatment plant (WTP) through a 14-in. underground line for treatment and subsequent distribution. Raw water can also be supplied via a pressurized feed line from the PPS when the SPS is drained. The WTP can process up to 2.25 million gallons of raw water per day. Treated potable water is stored in two 250,000-gallon clear wells and a 250,000-gallon elevated tank.

The WTP (Facility 1504) is a Class F-3 type facility (Public Water System No. 0004408 – Non-Transient, Non-Community) supplying an average flow of approximately 700,000 gallons of potable water per day. The WTP includes two 1,000 gpm effluent pumps, one 500 gpm effluent pump, and a 5,000 gpm backwash pump. A settling basin with a coagulation basin (Facility 1502) adjoins the WTP building. A separate chlorination building (Facility 1512), which includes chlorine dioxide pre-treatment and chlorine gas post-treatment, is located across the coagulation basin from the WTP building. Water treatment includes chlorine dioxide injection; flash mix of potassium permanganate, alum, and lime; mixing in flocculation chambers to coagulate solids; settling of solids in the settling basins; addition of carbon and subsequent filtering in sand filters; and final addition of chlorine before storage in the clear wells (Facility 1503).

The potable water supply distribution system is a looped grid of over 13 miles of six- to 12-in. mains that serves over 150 buildings, structures, and areas within the AEDC complex and includes the fire-fighting water supply. Approximately 75% of this distribution grid was installed in the 1950's and is constructed of cast iron pipe. The remainder of the system is constructed of polyvinyl chloride (PVC) pipe. The water distribution system is scheduled for annual repair or rehabilitation to maintain good condition and ensure the capacity for additional for growth.

The City of Estill Springs Water Department supplies water to other areas of the base, including the Arnold Village family housing area, the Visiting Officer's Quarters, the Family Camping Area (FamCamp), Arnold Lakeside Club, and the AEDC recreation area. Potable water is supplied to the airfield, golf course, and the National Guard Rifle Range by groundwater wells.

2.1.1.1.2 Cooling Water Supply

More than 70 billion gallons (214.8 acre-feet) of cooling water per year are used by the AEDC test facilities and other industrial users to dissipate heat from equipment and processes. The cooling water system provides water for AEDC operations through 17.5 miles of cooling water supply and return mains. The AEDC cooling water distribution network includes an 84-in. diameter main header, a 72-in. lateral, and a 60-in. lateral capable of a maximum design flow of 200,000 gpm at 150 psi. Supply lines up to 78 in. in diameter deliver cooling water to specific test facilities. Figure 2-2 shows the location of the key components for the AEDC cooling water system.

The cooling water supply system consists of two principle components to provide the necessary cooling water flow rates for AEDC operations: 1) the raw cooling water distribution system, and 2) the ASTF cooling tower system. Depending on test operation demand, the raw cooling water distribution system and ASTF cooling tower system can be used separately or in concert. Raw water may be pumped from the secondary pumping station or the pumping station located on the southern end of the retention reservoir into either the raw cooling distribution network as once-through cooling water or to the ASTF cooling tower basin. Additionally, raw water can be pumped directly from the primary pumping station to the ASTF cooling water basin.

The ASTF cooling tower basin has a 1.3-million gallon reservoir and includes a makeup water valve rated at 20,000 gpm. The basin also includes seven pumps rated at 205,000-gpm flow at 58 psi to return water to the cooling tower. The cooling tower is used to reduce cooling water temperature from 95°F to 83°F at a total design flow of 205,000 gpm at 108 psi. The cooling tower consists of 12 cells constructed of ammoniacal copper arsenite pressure-treated Douglas fir lumber with three feet of PVC corrugated fill material.

The ASTF cooling tower system can be operated to support most facilities as a recirculation system in which the cooling water is gravity-drained to the ASTF return basin and then pumped back to the cooling tower. Make-up water is periodically required for the recirculation system because of losses due to evaporation and system leakage. For facilities that have no return pipes available, water is discharged to one of three drainage ditch systems. For some facilities, the water is not circulated back to the ASTF cooling tower because of potential contamination from testing operations. Cooling water that is not recirculated returns to the retention reservoir through Rowland or Bradley ditch.

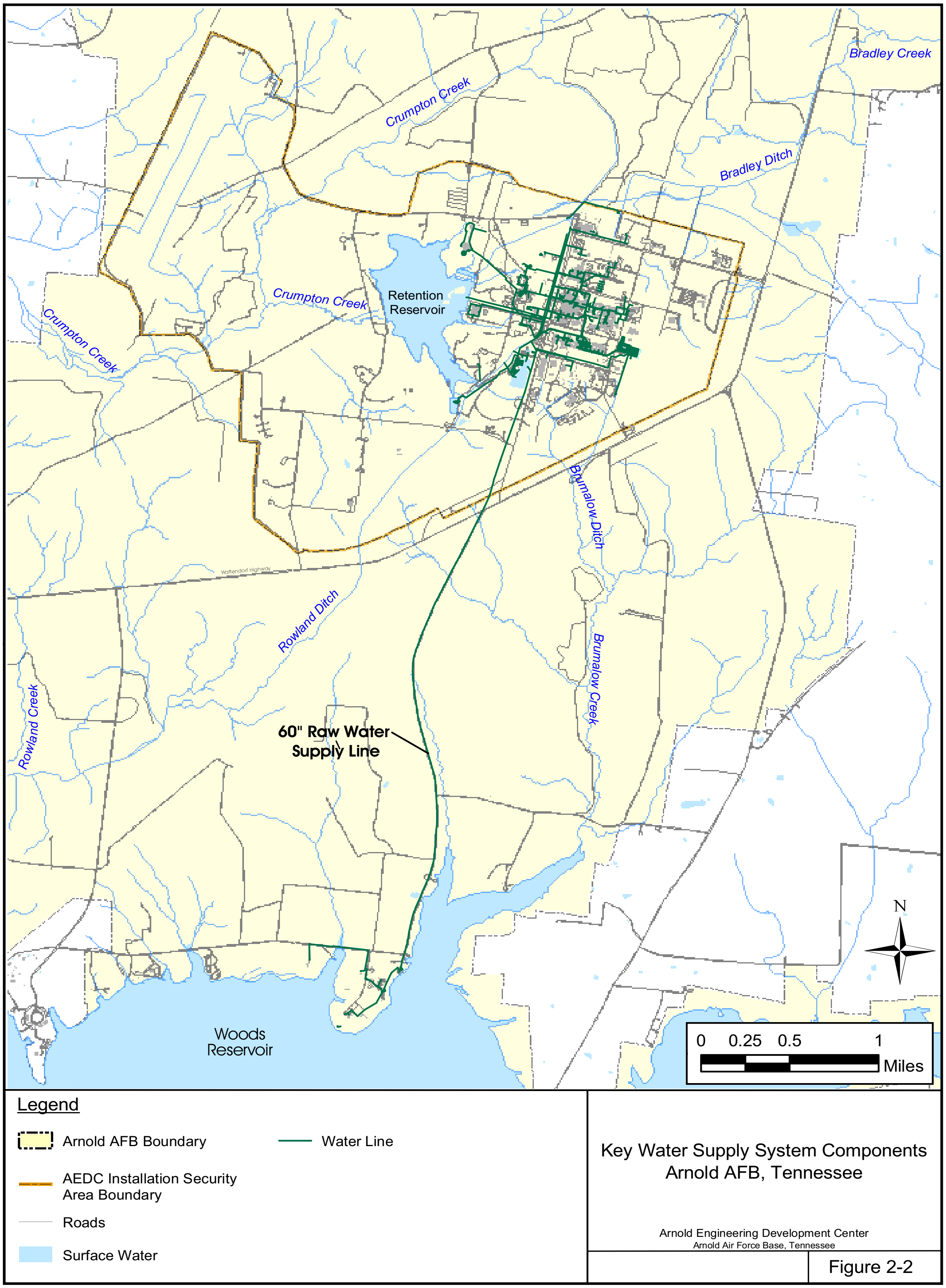


Figure 2-2. Key Water Supply System Components

2.1.1.2 Stormwater Drainage System

The stormwater drainage system controls base stormwater flow to prevent flooding and uncontrolled releases to local streams. Most stormwater at AEDC is collected by a system of curbs and gutters, underground storm mains, and open ditches. A system of nearly 150 sump pumps, about 20 miles of underground mains, and over 19 miles of open ditches convey the majority of stormwater within AEDC to Rowland Creek, Bradley Creek, and Brumalow Creek, which lie within the Elk River Watershed. The northwestern-most portion of the industrialized area drains into Crumpton Creek, which lies in the Duck River Watershed. Figure 2-3 shows key features of the stormwater drainage system.

Most process water and surface water discharge is contained within AEDC. All water discharged into Rowland Ditch beginning at its headwall is diverted into the southern end of the retention reservoir. Discharge to Bradley Ditch and Brumalow Ditch are diverted to the retention reservoir and ASTF cooling tower basin, respectively, through pumpback systems. Water flows off of AEDC through Bradley and Brumalow Ditches only during storm events that generate flow exceeding the capacity of the pumpback systems.

Discharge to the upper reaches of the Rowland Ditch (labeled as a return ditch on Figure 2-4) enters the southern end of the retention reservoir. Skimming booms stretch across this portion of the reservoir so that floating contaminants are diverted into skimming basins for collection and removal. A turbidity curtain suspended by a floating boom is used to direct flow into the main area of the reservoir to maintain adequate residence time for solids to settle before any discharge to a tributary of Rowland Creek.

Located at the headwaters of a tributary to Brumalow Creek are two inverted siphon dams and one skimming dam to remove any floating contamination from discharged AEDC process water. The inverted siphon dams work essentially as gravity oil/water separators wherein the water is detained behind the dam and discharged by gravity through an intake below the water surface (i.e., below the floating contamination). This system also allows solids to settle prior to final discharge. Water is transferred to the ASTF cooling tower basin through the pumpback system located in front of the skimming dam. Any overflow from storm events flows through a skimming pond located south of the AEDC installation boundary where inverted siphon drain pipes contain any residual sheen or floating contamination before discharging to a tributary of Brumalow Creek.

Discharge to Bradley Ditch flows to the retention reservoir through a pumpback system for recirculation into the cooling water system or discharge to a tributary to Rowland Creek. The system is the same as described above for Brumalow Creek, with the exception that Bradley Ditch has only one dam with valved inverted siphons. Water from the Bradley Ditch pumpback system enters the retention reservoir through a return ditch on the northeast side of the reservoir. Any overflow from storm events flows through a skimming pond located northeast of the AEDC installation boundary where inverted siphon drain pipes contain any residual sheen or floating contamination within the pond.

Stormwater and surface water discharge is further discussed in Section 3.1.1.4, *Surface Water*.

2.1.1.3 Sanitary Sewer System

Wastewater generated at AEDC is collected through an underground sanitary sewer system and treated at an on-base sewage treatment facility. The collection system includes 28 lift stations, nearly 9 miles of gravity flow and forced sewer lines, and the AEDC sewage treatment plant. Constructed in the 1950's, the system consists primarily of vitrified clay pipes, although newer construction consists of plastic pipes and repairs utilize cured in-place pipe (CIPP). All sewage treatment plants and wastewater discharges are subject to NPDES monitoring requirements.

The AEDC sewage treatment plant consists of two primary settling basins and one trickling filter, various pumps, drying beds, an aerobic digester, and an equalization basin to prevent the plant from peaking. The design flow is 660,000 gallons (2 acre-feet) of sewage per day. Effluent from the primary settling basin is processed through the trickling filters and settling basins, disinfected with ultraviolet light, and discharged into Rowland Ditch. The plant is in good condition and is currently operating at approximately one-third total capacity

Areas of the base not connected to the main sewage collection system utilize either a Recirculating Sand Filter (RSF) sewage treatment plant or septic tanks. A RSF sewage treatment plant is used for the Arnold village family housing, the Wingo Inn, Arnold Lakeside Club, and the Military Family Housing beach. Septic tank systems serve all other areas of the base including the primary pumping station, Gossick Leadership Center, the golf course, AEDC Main Recreation Area, Rocket Prep Area, X-Ray Building, Airfield Operations Building, FamCamp Area, Arnold Village Community Center and Softball Field, and the J-6 Steam Plant (AEDC 2005a).

2.1.2 Electrical Distribution System

Electrical power for AEDC is purchased directly from the Tennessee Valley Authority (TVA). AEDC is a high peaking user and the 21st highest energy user among Direct Served Customers (AEDC 2005a). AEDC has a Memorandum of Agreement with TVA for both a firm power of 18 megawatt (MW) and a Limited Interruptible Power (LIP) between 18 and 36 MW, as well as a variable amount of power called Variable Priced Interruptible (VPI). The VPI ranges from 36 MW to 664 MW (up to 700 MW maximum) and is used by AEDC to support the high peak requirements of high usage test operations.

Four 161-kilovolt (kV) lines and two 500-kV feeds supply the Franklin substation, located on 360 acres of leased Arnold AFB property. The Franklin substation has a capacity of 1,430 megavolt-amperes (MVA), with the highest recorded demand to-date reaching only 600 MVA. This substation supplies electrical power to the base.

Two 161-kV lines feed from the Franklin substation to AEDC's main substation, located southwest of the Power Control Building. Pressurized and oil-filled underground 161-kV lines feed eight distributing substations which include ASTF Airside, ASTF Exhaust, VKF, PWT, PES, ETF #1, ETF #2, and ETF #7. Transformers at each of the test center substations reduce power to 13.8 kV, 6.9 kV, 4kV, 16 kV, and 2.3 kV to meet facility and equipment requirements. This system contains 31 transformers with a total capacity of 1,827 MVA.

Additional electrical power is stepped down to 13.8 kV at the main substation and distributed to approximately 200 base-wide service points through 14 circuits consisting of approximately 124,725 ft of overhead service lines (13.8 kV) and approximately 141,315 ft of underground service lines (161 kV, 13.8 kV, and 6.9 kV). The electrical distribution system also includes multiple circuit breakers and associated switchgear.

The electrical power supply is backed up for emergency loss of power by a total of 35 fixed and portable emergency (diesel and gas-powered) generators. The backup generators range in electrical power generation capacity with the largest rated at 825 KW.

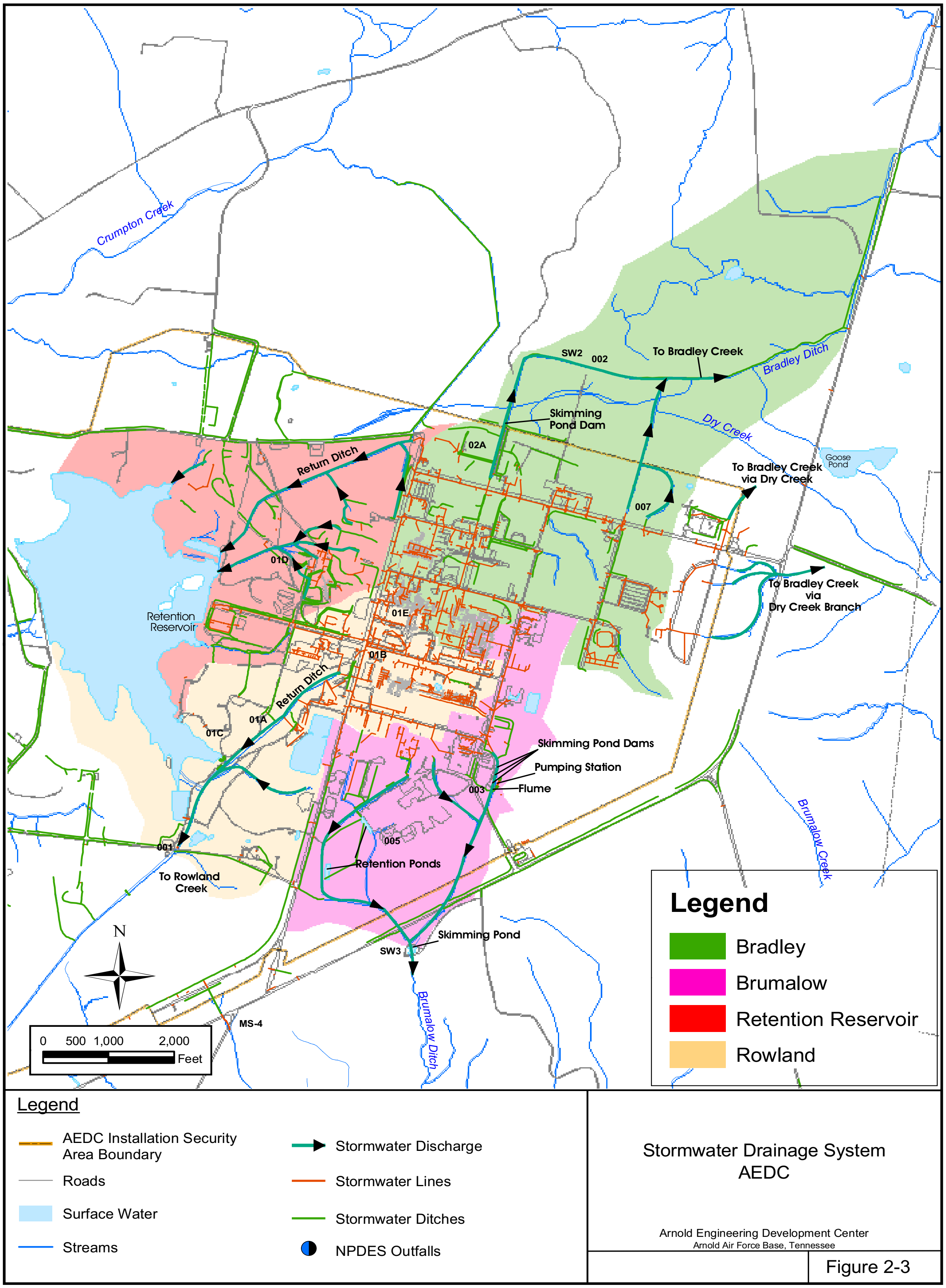


Figure 2-3. Stormwater Drainage System

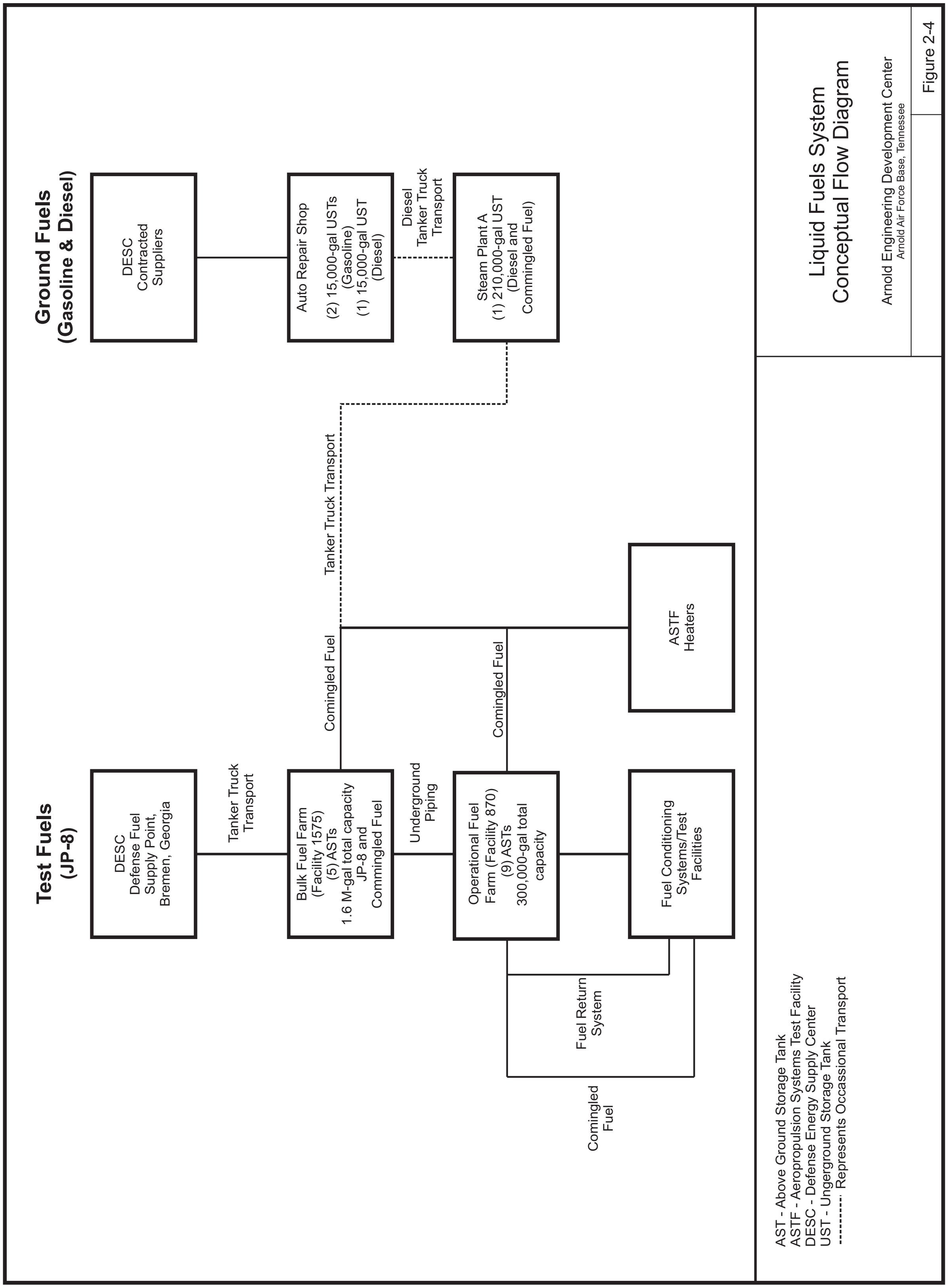


Figure 2-4. Liquid Fuels System Conceptual Flow Diagram

In addition to the power provided by TVA, the Duck River Electric Membership Cooperation provides power to operate the equipment for the Elk River Dam. The dam has backup power from a 50 KW generator. Tullahoma Utility Board provides electrical service to the golf course, tennis courts, shooting range, and the Tennessee Army National Guard area.

2.1.3 Liquid Fuel Storage and Distribution System

Liquid fuels used at AEDC include jet fuel to support turbine engine testing and ground fuels for general operations. Fuel currently used for testing primarily consists of JP-8 jet fuel but AEDC prepares blended fuels with additives as specified by test customers. Ground fuels include unleaded gasoline (MUR) and ultra low sulfur diesel (DL2). Commingled fuel, which is off-specification jet fuel or blended fuel consisting of mixtures that remain after testing or system purging, are stored and used for heating. Figure 2-4 shows the conceptual flow of testing and ground fuels.

All fuels are delivered to AEDC through the Defense Energy Support Center (DESC). Jet fuel is delivered to the Bulk Fuel Farm by truck from the Defense Fuel Supply Point (DFSP) in Bremen, Georgia, and transferred to designated above-ground storage tanks (ASTs). The Bulk Fuel Farm provides a total combined capacity of 1,603,992 gallons in five ASTs, consisting of 1,017,467 gallons of total capacity for jet fuel and 586,525 gallons of capacity for commingled fuel storage. The Bulk Fuel Farm contains transfer pumps, truck unloading/loading stations, loading headers, filter separators, a product recovery system at each AST, oil/water separators, connecting piping, a foam fire protection system, and secondary containment.

Test fuel is transferred from the Bulk Fuel Farm to the Operational Fuel Farm through two four-inch steel pipes encased in an impervious concrete containment trench. Fuel can also be unloaded at the Operational Fuel Farm directly from trucks when necessary. The Operational Fuel Farm consists of nine ASTs with a total combined storage capacity of 290,374 gallons, as well as dedicated transfer pumps to move the fuel to the various test assets, distribution piping and valves, truck unloading stations, loading headers, an oil water separator, a product recovery system at each AST, a foam fire protection system, and secondary containment to prevent the spread of any spill. Fuel is distributed from the Operational Fuel Farm to the various test facilities through a continuous loop of nearly four miles of four- and six-inch piping. The distribution system consists of primarily of carbon steel pipe set in containment trenches, with less than 10 percent consisting of aboveground stainless steel pipe. Fuel is transferred at a rate of approximately 275 gpm at 60 psi.

Unused test fuels piped from test cells and plant fuel systems are returned to the Operational Fuel Farm for storage through the underground return lines. Commingled fuels resulting from events such as purging of the test systems may also be piped to the Operational Fuel Farm from test assets for storage in designated ASTs. Commingled fuel from both the Bulk and Operational Fuel farms are piped to the ASTF Heaters for use. Commingled fuel is also occasionally transported by tanker truck for use at Steam Plant A.

In addition to fuel recovery systems and oil/water separators to minimize the risk of fuel spills and releases, all tanks at both the Bulk Fuel Farm and Operational Fuel Farm have an automatic pressure shut-off valve and alarm that is automatically triggered when a tank reaches its safe full level or a pressure drop is detected when pumping fuel to a test facility. Both the Bulk Fuel Farm and the Operational Fuel Farm also include automatic fuel gauges. Fuel tanks in use are inventoried at the end of each week and all tanks are inventoried monthly to validate the accuracy of the gauging systems and assess the potential for leaks if the meter readings and physical inventory do not match.

In addition to the ASTs associated with the Bulk and Operational Fuel farms, there are a total of 423 ASTs throughout AEDC that store various fuels, gases, and oils; 165 of these ASTs have a capacity of 660-gallons or greater. In addition to the three USTs at the ARS, there are six unregulated USTs located at various base facilities.

Ground fuels used for AEDC support operations (gasoline and ultra low sulfar diesel) are delivered to the Automotive Repair Shop (ARS) by DESC commercial contractors. The Automotive Repair Shop has two 15,000-gallon capacity underground storage tanks (USTs) for unleaded gasoline and one 15,000-gallon capacity UST for ultra low sulfar diesel fuel. These three USTs are regulated under the authority of the state of Tennessee.

2.1.4 Natural Gas Distribution System

The Elk River Public Utility District (ERPUD) supplies natural gas to AEDC. Natural gas is supplied to the industrial portion of the Center through an ERPUD owned pressure reducing and metering station at 100 pounds per square inch gauge (psig). ERPUD also serves the wastewater treatment plant, paint shop, and commissary through separate service connections that contain pressure regulators and meters. These connections are metered and billed as separate accounts from the AEDC gas utility system.

Natural gas is used as a heating fuel for test associated heaters, dryers and plant equipment and for the production of steam at two steam plants. Gas consumption is metered at each steam plant and test facility. The system piping is coated carbon steel and most of the system was installed in the 1970s. The last major extension was the 6-inch line to the J6 Test Area in 1993. The gas utility system is radial and none of the buildings can be fed from different paths.

The AEDC gas distribution systems consist of approximately 14,500 linear feet of piping. Pipe sizes range from 0.5 to 12 inches. Other than Steam Plant C, which is served by three separate regulators, there are nine facilities connected to the AEDC natural gas system. Each facility that uses gas has at least one pressure regulator to lower gas pressure for equipment use. All devices that use natural gas are downstream of meters, although not all users are individually metered. There are 22 meters installed for internal charging purposes. There are also two meters inside of Steam Plant C used to meter the natural gas which can only be read from the Steam Plant C control system.

Natural gas is supplied to AEDC in an odorized condition and there are no odorization facilities included in the AEDC natural gas distribution system. There are no compressed natural gas (CNG) fueling stations on Arnold AFB.

Depth of burial for the natural gas distribution piping averages between 2 and 3 feet below ground surface. Since the piping is metallic, tracer wire has not been installed. Approximately 10 percent of the gas distribution piping is located below paved surfaces.

An impressed-current type cathodic protection system serves the natural gas distribution piping. This system consists of 3 rectifier units with 34 test points located at strategic locations along the course of the line. Monthly maintenance checks/data collection is performed on the AEDC portion of the cathodic protection system to determine the functionality/degradation of the systems. Coordinated management of the cathodic protection system for natural gas lines, as well as other soil or ground contacting metal structures, electrical power conduits, water piping, etc., is required to assure protection of the natural gas piping.

2.1.5 Steam Supply System

Two central plants, Steam Plant A and Steam Plant C, provide steam to over 90 base facilities and testing functions. A third plant, Steam Plant B, is no longer in use. The steam system is primarily for the purpose of providing steam to test operations, with base heating as its secondary purpose. The steam distribution system was originally built in the early 1950's but most of the original direct-buried system has been replaced. Figure 2-5 presents a system conceptual flow diagram.

Steam Plant A (Building 1411) is a low-pressure steam system generating approximately 200 psi saturated steam. This steam plant has four steam boilers serving the general base facilities, ETF, ASTF, PWT, VKF, and associated support areas. Three boilers in Steam Plant A are rated at 60,000 lb/hr steam and one boiler is rated at 35,000 lb/hr steam. Steam Plant C (Building 563) is a high-pressure steam system generating approximately 750 psi saturated steam using a single-boiler system, which is rated at 42,000 lb/hr steam. This plant is used primarily for the test requirements of the J-6 test asset but also supports the T-3, J-1, J-4, and J-5 test assets. Steam Plant C is also used as emergency backup for Steam Plant A and the main distribution system. Because Plant A is a low-pressure system, it cannot be used as backup for Plant C.

The steam distribution and condensate return system is over seven miles long and contains approximately 16 miles of piping, including shallow-trench, aboveground, and buried piping. The system includes manholes, steam traps, valves, 43 meters to measure flow, and condensate return pumps for controlling the flow of steam and condensate return. The system delivers approximately 1.4 million pounds of saturated steam per day on average for testing requirements, freeze protection, and base heating.

The steam plants use natural gas as the primary fuel supply, although Steam Plant A can use commingled fuel or No. 2 fuel oil. An average of approximately 1 million cubic feet of natural gas per day is used to fuel the steam plants, but peak demands on cold days with test operations can range over 2 million cubic feet of natural gas per day. Air emissions from each steam plant are regulated through the AEDC Title V air quality control air permit [Sources 01 – 04 (Steam Plant A) and Source 43 (Steam Plant C)].

Potable water is used as make-up water for losses from the steam supply system. The potable water is first treated with a water softening system using a resin and is then processed through a reverse osmosis (RO) system. Both the water softening resin and the membrane in the RO system require routine backflushing. The backflushed material from the resin is discharged to the sewage treatment plant while the reject water from the RO system is discharged to the storm sewer system.

2.1.6 Heating and Cooling

AEDC has approximately 1,200 air conditioning and refrigeration systems supporting facilities that total over 2.8 million square feet. Base air-conditioning systems have a total capacity of over 10,000 tons of cooling. Unit capacities range from one to 400 tons, with the average unit approximately 20 tons. The base air conditioning systems use air cooling towers, and the base cooling water system as condenser cooling sources. The base has over 1,000 heating and ventilating systems serving the facilities. The majority of the heat is supplied from the base steam distribution system. The steam is either used directly or is supplied to a heat exchanger of a hot water system.

An Energy Monitoring and Control System (EMCS) is utilized to more efficiently manage base energy usage. Approximately 75 EMCS-managed facilities are connected to a central control facility in Building 1525. The EMCS provides 24-hour-a-day, seven-day-a-week monitoring of energy requirements generated by base HVAC needs.

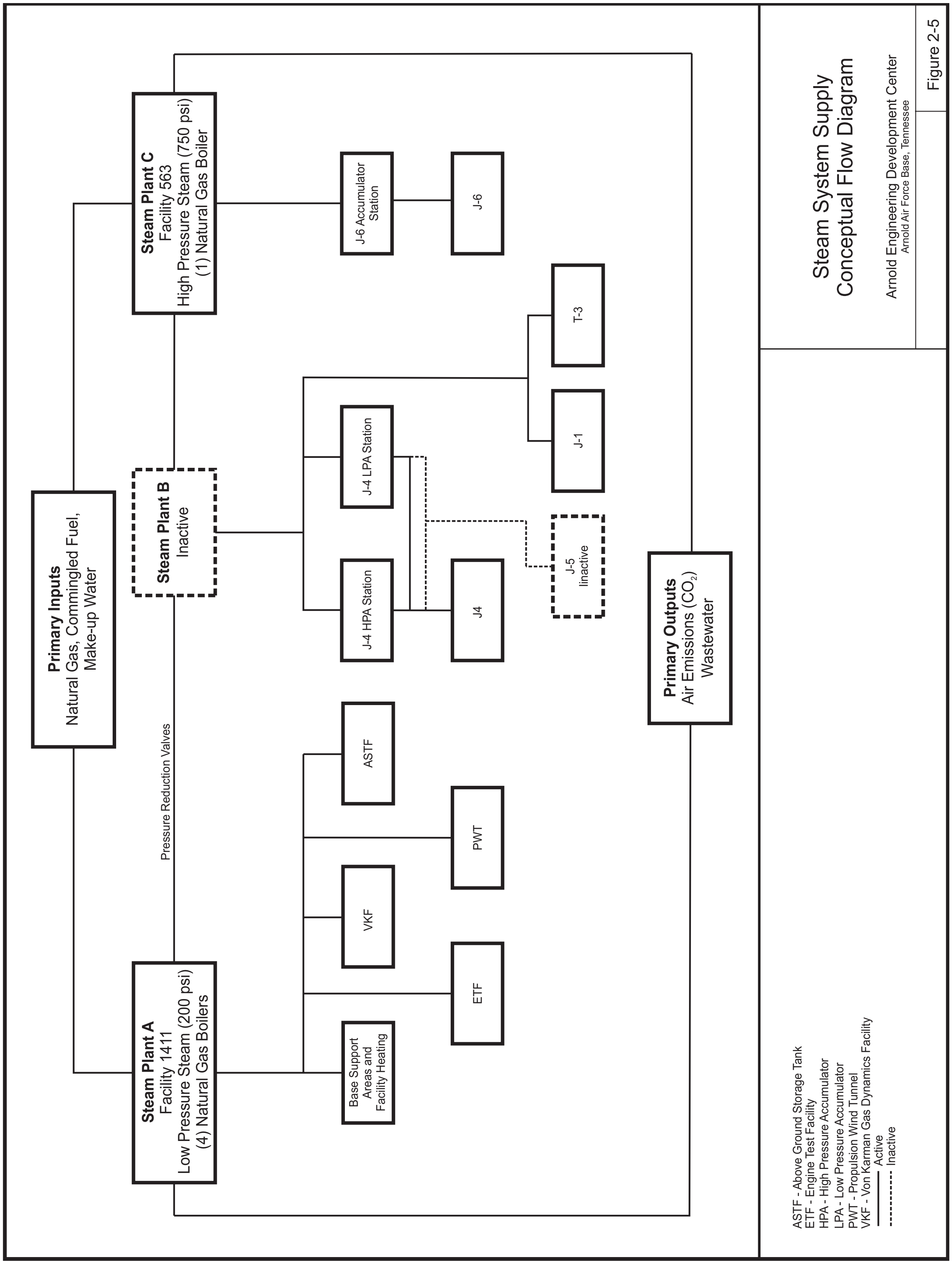


Figure 2-5. Steam System Supply Conceptual Flow Diagram

2.1.7 Communications System

The communication infrastructure consists of copper, fiber optic, coaxial cables, and a concrete duct system. The copper cable plant provides switched and dedicated circuits from the base Dial Central Office, Building 251, to all buildings on base. The copper distribution system consists of 10 main cables that serve the base's telephone, low speed data, and alarm requirements.

The fiber optic distribution system is a combination of a star configuration of multimode fibers from the Central Computer Facility, Building 1103, out to each of the distribution hubs and then to their satellite buildings. There is also a star configuration of single mode fibers from Building 251 to individual buildings. The base has an extensive concrete multi-cell underground duct system throughout the majority of the industrial area. This secured duct system houses fiber optic cable for unclassified as well as classified communication networks.

All communication and computer planning follow the guidance of the *AEDC Communications-Computer Systems Basewide Integrated Plan* and the AFMC Base C4I Systems Blueprint.

2.1.8 Support Facilities

Facilities supporting AEDC testing operations include administrative buildings, various laboratories, warehouses, the model shop, painting and sandblasting facilities, and maintenance shops. These facilities consume utilities but have limited resource input and limited potential for discharge or emissions, and therefore have limited potential for environmental impact. Select support facilities are briefly summarized below including inputs and outputs for their operation. Operations at all support facilities are managed in accordance with the Hazardous Materials (HAZMAT) Pharmacy system and base solid and hazardous waste management plans.

Administrative buildings include office buildings, the medical facility, the commissary and base exchange (BX). These buildings require utilities for heating, power, water, sanitation, and communications but have limited resource input or output.

Warehouses and storage facilities are located throughout AEDC for receiving, inventorying, and storage of materials and equipment used at the AEDC. The primary warehouse and storage facilities include the Shipping and Receiving Warehouses and the Test Equipment Storage Facility located at the south end of the AEDC complex. Numerous smaller storage facilities are located throughout the AEDC complex to support individual facilities, such as gas cylinder storage, drum storage lockers, and equipment buildings.

AEDC has a paint shop and sandblasting facilities. The primary inputs to these facilities are paint, solvents, and sand. The primary outputs are air emissions from the sandblasting and painting operations. While these air emissions are not individually regulated as an emissions source under the Title V air quality control permit, the general conditions of the permit apply as well as regulations under the CAAA for potential emissions of VOCs.

The Model Shop and various satellite fabrication shops are used to repair, construct, maintain, and install test hardware. This manufacturing capability is necessary to modify test hardware and test asset configurations to meet constantly changing test needs. The Model Shop also functions as a general purpose shop and maintenance facility. Several outlying structures and features support operations at the Model Shop, including the pipe and fabrication shops, flame cutting and shear machine sheds, vapor degreaser and riggers maintenance buildings, and the metal storage area.

Several laboratories provide support to the test assets and conduct research necessary for AEDC testing. Laboratory services ensure the reliability and accuracy of materials, instruments, equipment, and test articles. Laboratories include the Chemical Lab, which analyzes fuels, gases, and other materials before use to ensure compliance with test specification and requirements; the Metallurgical and NDE Lab, which verifies the structural integrity of critical test hardware and facility components; the Photographic Lab, which provides comprehensive still and motion picture coverage of tests; the Precision Measurement Equipment Lab (PMEL), which calibrates and repairs instruments used to control and measure test conditions and to acquire data from test articles; the Force, Flow, and Dynamics Building, which calibrates dead weights used in the testing; the High-temperature Lab; the Plume Data Diagnostics Lab; the Experimental Research Lab; and the FSD Research Building.

The primary facilities for maintenance and repair of base support vehicles are the Automotive Repair Shop and the Locomotive (Heavy Equipment) Maintenance and Storage Shed. General maintenance shops are located throughout AEDC for support of individual test assets, including the PWT Pipe Shop, ETF-A Valve Repair Shop, and ETF Maintenance Shop. These facilities use petroleum, oil, and lubricants (POL) and hazardous materials such as solvents.

The Chemical Cleaning Facility uses acid baths to clean steel tanks, including a 1,200-gallon phosphoric acid bath. A nitric acid/hydrofluoric acid bath is used to clean stainless steel piping and tubing. The primary resource input is acid and the primary waste is spent acid. The air emissions from the Chemical Cleaning Facility are regulated under the Title V air quality control operating permit for which VOC emissions are tracked and reported for fee assessment. No emission limits are imposed, although regulations under the CAAA for potential emissions of VOCs would apply.

2.2 Health, Safety, and Environmental Management

AEDC is centrally controlled by a unified set of management systems to maintain orderly and consistent operations. The general objectives of these systems are:

- Achievement of the AEDC mission as the primary and paramount goal.
- Completion of testing and facility operations in a uniform and consistent manner.
- Compliance with laws and regulatory requirements to minimize potential adverse effects on the environment and to protect workers and the community.

Comprehensive, integrated safety, health, and environmental management systems are developed, implemented, and maintained to ensure protection of human health and the environment and compliance with relevant laws, regulations, EOs, DoD directives, and AFI's. Management systems include programs for worker safety, emergency response, hazardous materials and waste management, protection of air and water quality, fish and wildlife management, integrated ecosystem management including protection of rare, threatened and endangered species, and management of cultural resources. These systems, which are common to the Proposed Action and No Action alternative for both the near term and long term, are addressed in detail in Section 3 under the relevant affected environment discussions.

2.3 Research, Development, Test and Evaluation (RDT&E) Systems

Current RDT&E systems operation and maintenance at AEDC represent baseline conditions shared by the Proposed Action and No Action alternative. The following subsections describe the existing test facilities, including physical descriptions, general operations, and testing capabilities. The descriptions of test assets are designed to provide sufficient information to understand their function such that the potential for environmental impacts can be discussed in Section 4, *Environmental Consequences.* All assets that are in production or that could be brought back on line in a reasonable time frame (standby or mothballed status) are described regardless of their recent operational history.

While aerodynamics, aeropropulsion, and aerospace (space and missile) tests are generally conducted within specific facilities, some facilities support more than one type of test operation (Table 1-1). For the purpose of this EA, the facilities are grouped according to their predominant test operation.

2.3.1 Wind Tunnels

AEDC has seven wind tunnels that are either operational or in a mothballed status. These tunnels are used for flight systems tests of large-scale aircraft models. Two of the wind tunnels (16T and 16S) can also be configured for aeropropulsion testing operations. Wind tunnel tests can also involve store-separation investigations which ensure that bombs, missiles, or other internally or externally-carried stores separate cleanly from the parent aircraft when released.

2.3.1.1 16S Supersonic Wind Tunnel

Tunnel 16S is used both for conventional aerodynamic tests and for combined aerodynamic and aeropropulsion tests. Large and full-scale models of aircraft, missiles and rockets are tested with propulsion systems installed and operating. Tunnel 16S is capable of operation at Mach numbers from 1.5 to 4.5 (supersonic speeds). Mach numbers above 3.40 require operating the main drive and the Plenum Evacuation System (PES) compressors in series. Pressure of the airflow sections can be varied to simulate altitude conditions from 50,000 ft to about 150,000 ft. The maximum attainable pressure is a function of Mach number and the availability of electrical power. The minimum stagnation temperature obtainable varies from about 100 degrees Fahrenheit (°F) to 565°F.

Tunnel 16S measures approximately 700 ft long by 300 ft wide. The large size of the 16S test section allows for full-scale installations to test engine performance and airframe aerodynamics. Rocket propulsion systems and their external aerodynamics are also investigated. Testing conducted in 16S includes air-breathing engine and rocket propulsion systems testing, store-separation testing, decelerator testing, static stability testing, and dynamic stability and magnus effects testing. Tunnel 16S has a scavenging system for removal of combustion products.

Tunnel 16S is currently in a “mothballed” status.

2.3.1.2 16T Transonic Wind Tunnel

The primary differences between 16T and 16S are maximum Mach numbers, stagnation temperature, and simulated altitude. Tunnel 16T is capable of operation at Mach numbers from 0.06 to 1.60 (transonic speeds) and simulated altitudes from sea level to 90,000 ft. The tunnel stagnation temperature can be varied from minimum of approximately 80°F, depending upon available cooling water temperature, to a maximum of 120°F. Tunnel 16T measures approximately 425 ft by 225 ft and has the same size test section as 16S. A flexible nozzle regulates the velocity of the airflow as it enters the test section.

Models in tunnel 16T can be supported in a variety of ways including a High Angle-of-Attack System (HAAS) for evaluating extreme flight altitudes and a Captive Trajectory Support (CTS) system for weapons integration testing.

Testing conducted in 16T includes air-breathing engine and rocket propulsion systems testing, store-separation testing, decelerator testing, static stability testing, and dynamic stability and magnus effects testing. Tunnel 16T has a scavenging system for removal of combustion products when testing rocket motors or gas turbine (jet) engines.

2.3.1.3 4T Transonic Wind Tunnel

Tunnel 4T is 12.5 ft in length and has a 4-ft-square cross section. The tunnel can maintain a Mach number range between 0.05 and 2.46 (transonic speeds). The compressor drive motor is a 20,000 hp synchronous motor that can be powered by a variable frequency power system (VFPS) providing infinite speed control from about 100 to 1,800 rpm. The 4T tunnel utilizes a three-stage axial flow compressor providing a Mach number range of 0.2 to 1.3. For Mach numbers greater than 1.3, airflow is provided by the PES compressors. The compressor inlet guide vanes and the three stator rows are remotely controllable through an angle range that satisfies the range of volume flow requirements.

In addition to the conventional force and pressure tests of aerodynamic models, tunnel 4T can be used for highly specialized testing techniques such as inlet performance, force testing, captive trajectory store separation, store-drop studies, dynamic stability investigations, and magnus effects testing.

2.3.1.4 "A" Supersonic Wind Tunnel

Tunnel A is a 40 in. by 40 in. cross-section continuous, closed-circuit, variable-density, wind tunnel that operates between Mach numbers 1.5 and 5.5. Air supply for Tunnel A is provided by a main VKF compressor system for a wide range of mass flows and stagnation pressures up to 200 psia. A high-pressure air reservoir is used to provide rapid pressure changes required for different test points. Tunnel A is primarily used to investigate vehicle static/dynamic stability and control properties, booster and shroud separation characteristics, jet interaction and control effectiveness, inlet performance, aeroheating and surface pressure distribution, and to validate aerodynamic and aerothermal computations.

2.3.1.5 "B" and "C" Hypersonic Wind Tunnels

Tunnel B is a 50-in. diameter tunnel for testing speeds of Mach 6 and 8. Tunnel C, used for testing speeds of Mach 10 has an identical test section to Tunnel B but can also be used for aerothermal testing at Mach 4 and 8.

Both tunnels are closed circuit with axisymmetric contoured nozzles that may be operated continually over a range of pressure levels with air supplied by the main VKF compressor system. Stagnation temperatures sufficient to avoid liquefaction in the test section of each tunnel are obtained with two natural gas-fired combustion heaters in combination with the compressor heat of compression. Tunnel C requires the use of an electric heater in addition to the two natural gas heaters. The entire tunnel (throat, nozzle, test section, and diffuser) is cooled by integral, external water jackets.

Tunnels B and C are primarily used to investigate static force, pressure, temperature, dynamic stability, heat transfer rate, and fluctuating aerodynamic measurements; material evaluation, jet-interaction, free-flight, and plume simulation testing; and flow visualization and direct photography.

2.3.1.6 "C" Aerothermal Wind Tunnel

The Mach 4 Aerothermal Tunnel C is a closed-circuit, high-temperature, supersonic free-jet wind tunnel with an axisymmetric contoured nozzle and a 25-in.-diam nozzle exit. This capability requires only a nozzle and throat change from Mach 10 to Mach 4 and utilizes all of the Tunnel C circuit. Mach 4 Aerothermal Tunnel C operates continuously over a range of pressures from nominally 20 psia at a minimum stagnation temperature of 260°F to 180 psia at a stagnation temperature of 1,110°F. Alternate configuration of Tunnel C allows operation at a maximum temperature of 1,440°F and a maximum pressure of 100 psia. The air temperatures and pressures are normally achieved by mixing high temperature air (up to 1,790°F) from the primary flow discharged from the electric heater with the bypass air flow (at 980°F) from the natural gas-fired heater. The primary and bypass air flows discharge into a mixing chamber just upstream of the Aerothermal Tunnel C stilling chamber. The entire aerothermal nozzle insert, consisting of the mixing chamber, throat, and nozzle sections, is water-cooled by integral, external water jackets.

Aerothermal Tunnel C is primarily designed to provide a true temperature test environment for the evaluation of flight hardware, including materials evaluation testing, but it can also perform the types of tests described for Hypersonic Wind Tunnel C.

2.3.1.7 Airflow Calibration Laboratory (ACL) Wind Tunnel

The ACL, a small wind tunnel, was originally designed as a low-density hypersonic tunnel. The test asset, which is 7.4 ft in diameter and 12 ft long, can be pumped down to less than 0.5 psia. The ACL has been modified to serve as an airflow calibration laboratory. This test unit can maintain wind speeds of Mach 1.75, 2.5, 4, and 6. Its airflow capabilities can be used, with minor modifications, to provide calibrations for various items such as the mass flow of wind tunnel inlet/nozzle models, air-powered turbine simulators, flow-field pressure probes, total temperature probes, and hot (film) wire anemometers.

The AEDC VKF Auxiliary Mass Flow System provides air to the ACL. The air supply originates from a 4,000-psia reservoir regulated by pneumatically operated pressure control valves. The mass flow system can provide metered flow rates of up to 10 lbm/sec at pressures up to 1,900 psia. Air temperatures up to 700°F are provided through the mass flow system using a gas heater.

2.3.2 Aeroballistic and Impact Ranges

The aeroballistic ranges consist of both aerodynamic gun ranges and impact ranges. The aerodynamic gun range, Hypervelocity Range G, test scaled models of space vehicles, missile nosecones, projectiles, and other components in free-aeroballistic flight under various environmental conditions. Models are launched at velocities up to 23,000 ft/sec (Mach 21). Impact ranges, including Hypervelocity Impact Range S1, Impact Range S3, Range I, and the Impulse/Impact Range, determine the effects of meteoroid and projectile impacts upon spacecraft structures, high-speed aircraft, and other similar events.

2.3.2.1 Range G Complex

The Hypervelocity Range/Track G Complex consists of three test assets. Hypervelocity Gun Range/Track G consists of a large bore (84-mm or 203-mm) two-stage light-gas gun, a 305-m test chamber with projectile guidance capability (track), and a projectile recovery system. Range I, or the Impact Facility, consists of a 64-mm two-stage light-gas gun and a 10-m target tank, is primarily used to perform impact and lethality tests. The Impulse/Impact Range is a free-piston shock tunnel used to perform real-gas testing for CFD code validation.

2.3.2.2 Hypervelocity Gun Range/Track G

This facility is used to test subscale models at reentry speeds and environmental conditions. The models can be tested in either a free-flight mode where the model flight path is unconstrained and the model is destroyed at the end of the trajectory, or in the track mode where the flight path is constrained and the model is recovered. In the free-flight configuration, the test unit provides aerodynamic, reentry physics, heat transfer, and impact testing. In the track configuration, the test assets provides nosetip transition, ablation, erosion, and actively cooled nosetip testing. Range G is also equipped to study effects of wake, ablation, and erosion (dust, rain, and snow).

The facility is equipped with a test vehicle launcher that can accommodate a variety of launcher bore sizes. The launcher system is a two-stage powder-hydrogen gun approximately 220 ft long. The test unit includes a 929 ft long, 10 ft diameter steel tube within an underground service tunnel 20-ft wide and 13-ft high. A blast chamber absorbs the expanding muzzle gases. The range tank is divided into two sections by a bulkhead. These sections can be set to different pressures and can contain different gases.

The humidity in the test gas can be controlled to facilitate test environments. Temperature is regulated at 76±3°F with an air conditioning system. Test environments other than air, such as nitrogen, argon, and helium, can be provided to accommodate special test needs. A quick-opening valve between the sections maintains a pressure difference until arrival of the model. A four-stage system of mechanical vacuum pumps, which are cooled using non-contact AEDC raw cooling water, provides the range test pressure desired. Pressure of the test gas can be controlled between 1 and 1,300 torr.

The exhaust from the vacuum pumps used for test preparation is discharged to the atmosphere. Upon completion of testing, the range is vented to the atmosphere and then purged and ventilated using a 4,000 cfm and a 6,000 cfm fan exhausting through stacks 15 and 25 ft above ground surface.

2.3.2.3 Range I (Impact Facility)

The Impact Facility is located alongside the Range G launcher and shares some of the same support systems, including the vacuum system. The launch tube bore is 2.5 in. in diameter and 68 ft long. The powder chamber pump tube bore is 8.0 in. in diameter and the total length of the tube is 96 ft.

The vacuum tank is 8-ft-diameter and 80 ft long. The forward portion of the tank is a blast tank that absorbs the muzzle gases; the remainder of the tank is a target tank. The two sections of tank are separated by a bulkhead with a quick-operating valve to maintain appropriate pressures.

2.3.2.4 Impulse/Impact Range

The Impulse/Impact Facility is a hypersonic facility with a gas aerodynamic/ combustion test capability. The facility can be configured either as a two-stage light-gas gun to launch models at targets (impact) or as a free-piston reflected shock tunnel (impulse). The free-piston shock tunnel, which uses adiabatic compression to heat a light driver gas, is capable of producing very high stagnation enthalpy at high density. The velocities generally tested are between Mach 6 and 7.

The compression tube, high-pressure section, and dump/target tank are common to both facilities. The high-pressure section and associated mass addition act as an inertial mass (17 tons) for the system to reduce recoil. A secondary Mylar® diaphragm is located near the nozzle throat to isolate the test gas in the shock tube from the evacuated test section and blast tank.

2.3.2.5 Hypervelocity Impact Range S1

The VKF Hypervelocity Impact Range S1 is equipped with a two-stage, light-gas launcher. In addition to the launcher, which accelerates the projectile to the desired test velocity, the range has a blast chamber into which muzzle gases expand and in which the projectile is separated from the sabot. The range also has a connecting tube, along which instrumentation can be located, and three target chambers where impact occurs. The target range can be operated at vacuums as low as 0.001 torr. The target chambers of Range S1 are equipped with a large number of viewing ports to accommodate radiometers, spectrographs, and various photographic recording systems.

2.3.2.6 Impact Range S3

The VKF Hypervelocity Impact Range S3 is a test unit used primarily for low-speed impact studies. Past test programs included bird impact studies on aircraft canopies and space shuttle external tank spray-on foam insulation. The launcher consists of a 31-ft-long driver and a two-piece launch tube 60 ft long. The driver is charged with compressed air and the launch is initiated by mechanically cutting the Mylar® diaphragm that separates the driver and the launch tube. Launch velocity range is from Mach 0.37 to 1.3.

2.3.3 High Enthalpy Ablation Test Complex

The HEAT (ARC Facilities) complex is located in the AEDC High Temperature Laboratory and includes test assets H1, H2, and H3. These test assets provide high-pressure, high-enthalpy conditions simulating aeroheating environments consistent with endoatmospheric flight at velocities from Mach 4.6 to 18.4 for testing materials. The arc facilities reproduce thermal environments simulating flight above Mach 8 for long exposure periods required to validate thermostructural performance and survivability of materials and components. Figure 2-6 shows the conceptual flow for operation of HEAT test assets.

2.3.3.1 Test Unit H1

The HEAT-H1 Test Unit is an advanced performance arc-heated facility providing high-pressure, high enthalpy test conditions for qualification of thermal protection materials, nose tips, and electromagnetic apertures and structures for hypersonic missiles, space access systems, and reentry vehicles. Testing includes combined ablation/erosion capability, nosetip steady-state ablation, nosetip boundary-layer transition, wedge, and antenna window transmission studies.

H1 utilizes a segmented arc heater with multiple electrically isolated segments which form the heater plenum. The unique segmented construction allows the arc to be held at a fixed length to optimize heater efficiency and total enthalpy at high pressure and flow uniformity. A stilling/mixing chamber can be installed to mix cold air with the arc-heated air to decrease the total enthalpy, increase the flow Reynolds number, and improve the uniformity of the flow enthalpy across the test jet. H1 also can be used to simulate hypersonic erosion/impact using various sized graphite particles injected into the flow field and combined ablation/erosion testing. Dust particle flow rates from 5 to 60 grams (gm)/sec can be achieved using high-pressure nitrogen to force the dust through a metering orifice and into the air flow.

The segmented arc heater operates at approximately 20kV and 1,200 amps to provide heater chamber input ranges from 1,000 to 8,500 Btu/lbm over a pressure range of 20 to 120 atm. Power is provided through a 60MW DC power supply with a maximum open-circuit voltage of 50 kV and maximum current of 3,000 amps. An air supply from the VKF main high-pressure air compressor and storage tank system provides up to 30 lbm/sec at 3,800 psi, although normal operations require flow rates between 0.5 and 15 lbm/sec maintained by control valves and regulators. H1 components are cooled by a closed-loop, demineralized water system supplying water at flows of 1,500 gpm and pressures up to 1,500 psi. The demineralized water is cooled through a heat exchanger using AEDC raw cooling water supply.

2.3.3.2 Test Unit H2

The HEAT-H2 Test Unit is an arc-heated aerothermal tunnel providing high-enthalpy flow at high Mach numbers ranging from Mach 5.5 to 13.8 and dynamic pressures simulating hypersonic flight at pressure altitudes from 70,000 to 160,000 ft for periods up to 30 minutes. Testing capabilities are similar to H1. H2 utilizes a Huels-type arc heater to generate high-temperature, high-pressure air for expansion through a hypersonic nozzle into the evacuated test asset. Direction and distribution of the injected air can be selected to optimize the enthalpy distribution across the flow to match specific test requirements. H2 shares utilities, power, water, air supply, and data acquisition systems with H1. Exhauster pumping is provided by the AEDC PWT PES (Section 2.4.3).

2.3.3.3 Test Unit H3

The 70-MW HEAT-H3 arc heater provides a large, high-pressure, arc facility with sufficient size and performance for testing of full- and large-scale missile and reentry samples and structures. Testing capabilities are similar to H1. H3 is a 12-module, 50-percent geometric scale-up of the H1 segmented arc heater, and is designed to operate at over twice the available power level and mass flow of H1 while providing essentially the same flow field enthalpy and pressure.

2.3.4 Space Environmental Chambers

The VKF aerospace chambers provide spacecraft testing at all system levels and includes sensor calibration and mission simulation, thermal vacuum, radiation effects, and contamination testing. Simulated space conditions include space vacuum and cryogenic temperature, space thermal radiation environment, threat simulations, and vehicle vibration. The aerospace chambers include the Mark I, located in the Mark I Test Building, 7V, 10V, 12V, and 7A, located in the Mark 1 Engineering Lab (Building 1077) and the DECADE and MBS test assets, located in the DECADE Radiation Test Facility (Building 1088).

2.3.4.1 Mark I Chamber

The Aerospace Environmental Chamber (Mark I) simulates space conditions for solar and vacuum testing and can provide testing in zero gravity conditions for less than two seconds. The Mark I chamber is suitable for conducting tests on large space vehicles and a variety of space subsystems. It consists of a large, vertical, cylindrical vacuum tank, pumping systems, thermal environment systems, vehicle support and attitude control equipment, controls, and instrumentation. The building housing the chamber has ten working floors, including four floors below and six floors above ground. The chamber, which measures 42 ft in diameter by 82 ft in height, is contained in a room 68 ft by 68 ft by 109 ft high enclosure.

The Mark I Environmental Chamber can be configured for conducting separation or free-fall tests at vacuum conditions of 1.0E-04 torr monitored with high-speed motion-picture cameras and other instrumentation. A catch mechanism stops the test article at the bottom of the chamber. Thermal vacuum testing on space systems can also be performed using 77 Kelvin (-321°F) liquid nitrogen-cooled thermal surfaces and a heat flux system.

The Mark I Clean Room consists of three rooms that are temperature and relative-humidity controlled (72°±3°F with 45-percent maximum relative humidity). The clean room is serviced by a 15-ton air conditioning unit, six high-efficiency particulate air (HEPA) filter banks, and prefilters. This system provides 12,000 scfm of filtered and conditioned air for use during build-up and removal phases.

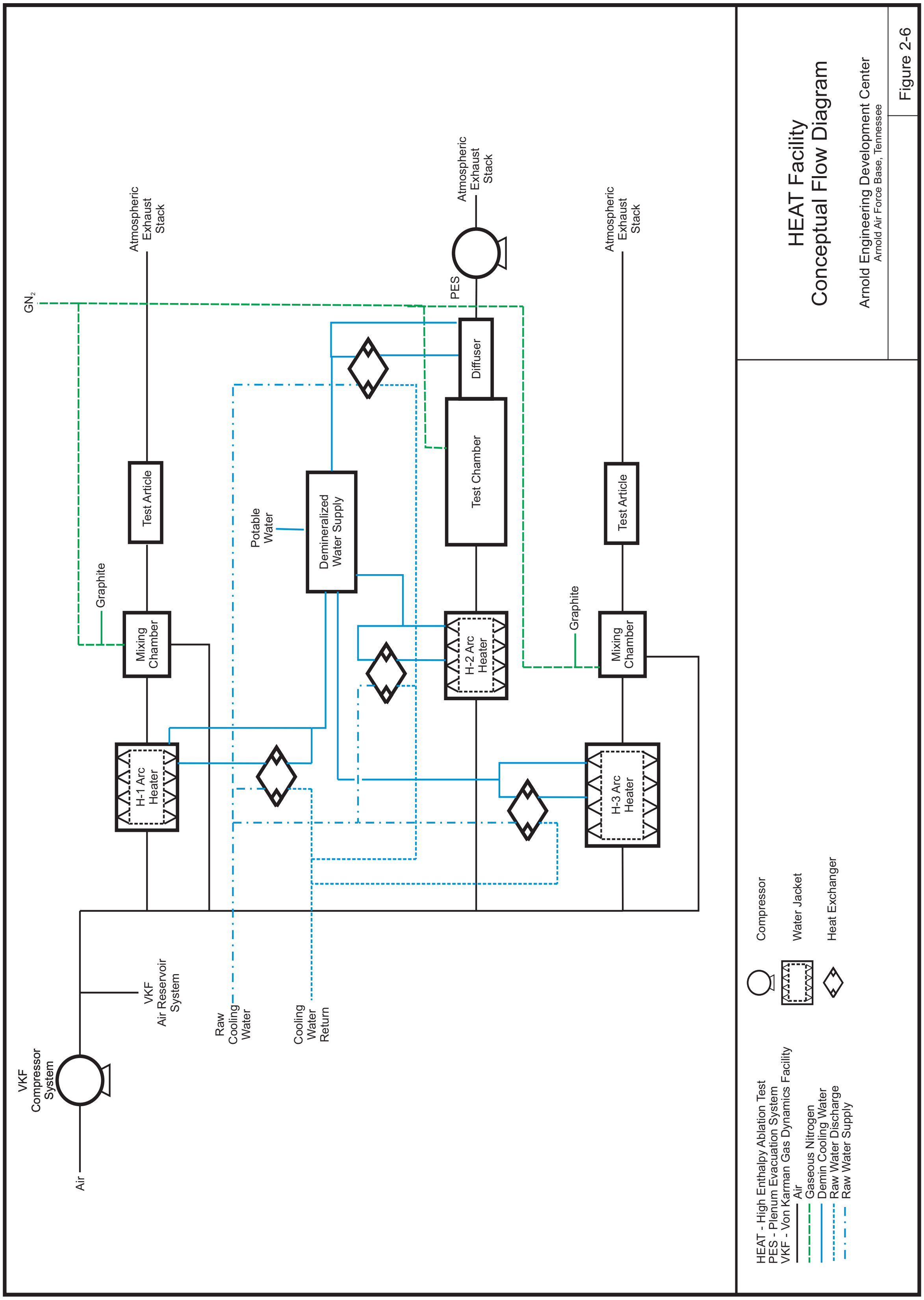


Figure 2-6. HEAT Facility Conceptual Flow Diagram

The Mark I support systems include both a conventional vacuum pumping system and cryopumping systems. The conventional pumping system is a combination of oil-sealed mechanical roughing pumps and Roots-type pumps, and oil diffusion pumps. The mechanical pumps reduce the chamber pressure to approximately 30 torr. The oil-sealed mechanical pumps then further reduce pressure to 10 torr. Subsequently the Roots-type pumps are operated to reduce the pressure to 1.0E-02 torr, followed by evacuation of the Mark I chamber to 1.0E-05 torr by the eight 32-in. oil diffusion pumps.

Background temperature of outer space is simulated by liquid nitrogen-cooled stainless steel surfaces within the chamber that are coated with high-absorptivity paint. A closed-cycle refrigeration system is used to maintain the liquid nitrogen supply. Gaseous helium-cooled cryopanels can be used inside the chamber to reduce the vacuum to as low as 1.4E-07 torr.

The infrared (IR) radiation source consists of a 10W CO_2 laser, attenuators, and various optics. Available beam irradiance over the sensor entrance aperture is approximately 0.001 watts per square centimeter (w/cm2).

The Mark I chamber is currently in a “mothballed” status.

2.3.4.2 7V Chamber

The 7V chamber is a cryogenic/vacuum facility providing sensor calibration against a low IR background. The 7V chamber incorporates an extensive capability for mission simulation, providing target and background sources for both above and below-the-horizon tracking, discrimination, and intercepts testing. The wide variety of high-fidelity radiometric sources provides background and targets.

The 7V chamber is 7-ft diameter, 21-ft long and contains a light-tight cryogenically cooled liner (20 Kelvin (-424°F)) for low radiometric background to simulate deep-space conditions. A combination of turbomolecular and cryopumps can be used to attain simulated pressure altitudes beyond 200 miles (less than 1.0E-07 torr). The chamber is housed within a Class 1000 clean room.

Collimated radiation from the target and calibration sources is provided by a diffraction-limited, two-element mirror system. Contamination control is critical to protecting the sensor and the test equipment. This control is maintained by careful design and selection of materials, the use of clean rooms, and careful pumpdown/cooldown procedures to cryopump contamination on non-critical surfaces.

2.3.4.3 10V Chamber

The 10V chamber provides a closed-loop ground test capability to assess multiband electro-optical sensor performance at cryogenic conditions under realistic operational scenarios. The capabilities of the 10V are suited for “deep space” testing of optical elements at required temperatures.

The 10V chamber is a horizontal cylinder 10 ft in diameter and 30 ft long containing a cryogenically cooled light-tight liner and optical benches. Each optical bench is mounted to the 150 ton seismic mass via columns that penetrate the vacuum shell though vibration isolation diaphragms to limit line-of sight vibration stability to less than 1 microrad. The chamber is fitted with a light-tight 20 Kelvin (-424°F) gaseous helium liner to simulate the background radiation of space. A combination of turbomolecular and cryopumps can be used to attain simulated pressure altitudes beyond 200 miles (less than 1.0E-07 torr). The 10V Chamber shares a single clean room with the 7V Chamber.

2.3.4.4 12V Chamber

Aerospace Chamber 12V provides thermal balance testing of small space vehicles and components. Long-term thermal balancing can be performed using solar-on, solar-off with liquid nitrogen background and rotating the test article to characterize the thermal load requirements while simulating orbital conditions. Other tests include characterization of hybrid solar arrays and measurement of space vehicle or vehicle component IR signatures between 5 and 22 micrometers.

The 12V chamber is 12 ft in diameter and 35 ft high. It is lined with 77 Kelvin (-321°F) liquid nitrogen cryopanel surfaces, which are used to simulate the thermal environment of space. For tests requiring a colder background, the 12V chamber has a gaseous helium-cooled inner liner, or shroud, which can be cooled and maintained at 10 Kelvin (-442°F) and evacuated to the 1.0E-08-torr level.

The 12V Chamber support system includes a 730-cfm roughing pump, a 140-cfm forepump with a 700-cfm blower, and a 32-in. valved and liquid nitrogen-baffled oil diffusion pump. The chamber uses liquid nitrogen traps and turbomolecular pumps in combination with a cryopumping system.

2.3.4.5 Small Laboratory Aerospace Test Chambers

Contamination studies at AEDC are typically performed in small vacuum chambers, located within the Mark I Engineering Lab, ranging in diameter from 18 in. up to 3 ft and from 1 to 5 ft in length. Most of the chambers have a vacuum capability of 1.0E-06 to 1.0E-07 torr and can be cryogenically cooled. The various contamination studies include optical properties (refractive and absorptive indices), measurements of contaminant films condensed on cryogenic optical surfaces, surface effects of contaminants on thermal control surfaces, solar cell efficiency degradation due to contaminants, and cryogenic or warm measurements of contaminant effects on mirror. These laboratory test chambers require limited support systems and have limited system resource inputs. System outputs are limited to incidental release of gases upon completion of testing.

2.3.4.5.1 Bidirectional Reflectance Distribution Function Chamber

The BRDF chamber is used for contamination studies including testing of outgassing properties of satellite and ground test chamber materials and evaluation of contamination monitoring devices such as the quartz crystal microbalance (QCM) and surface acoustic wave (SAW) mass detectors. It has also supported long-term performance evaluations, including preflight qualification of QCMs at temperatures as low as 10 Kelvin (-442°F) and reflective property changes in samples.

The BRDF chamber can measure the scattering effects of condensed contaminants on cryogenically-cooled, highly polished mirrors. A contaminant source deposits the outgassing products to be studied by condensing them on the cold test surface, which can be cooled to temperatures as low as 77 Kelvin (-321°F) using liquid nitrogen and 20 Kelvin (-423°F) using gaseous helium. A helium-neon or carbon dioxide laser beam enters the chamber and is incident on a mirror test surface. The radiation scattered from the cold mirror surface is measured in situ.

2.3.4.5.2 7A

The 7A chamber is a general- purpose chamber 3-ft diameter by 5-ft long with a 77 Kelvin (-321°F) or 20 Kelvin (-424°F) cryogenically cooled liner similar to the other aerospace chambers. The chamber is used for component functional checkout and development. This vacuum chamber uses cryopumps and turbopumps to achieve vacuum to 1.0E-08 torr.

2.3.4.5.3 Cryogenic Optical Properties Chamber

The 2-ft by 3-ft COP Chamber is used for experimental determination of the effects of thin film contaminants condensed on cryogenically cooled optical components. Data have been obtained for substrates cooled to both 77 Kelvin (-321°F) and 20 Kelvin (-423°F) using liquid nitrogen and helium gas, respectively. The COP Chamber can measure IR transmittance measurements for space-rated materials and determine the optical properties (refractive and absorptive indices) for cryogenic films. The COP Chamber is also used for investigating the optical effects of pure gases condensed on cryogenically cooled optical surfaces over a wavelength range from approximately 2.5 to 20.0 millimeters (mm).

2.3.4.5.4 Solar Absorptance Measurements Chamber

The SAM Chamber is used for reflectance studies of contaminated thermal control surfaces and for measurement of contamination effects on solar cell efficiencies. The surfaces in this chamber are maintained at room temperature. Reflectance measurements are made over the 0.25 to 2.5 mm wavelength range, which covers the range where most solar energy is concentrated.

2.3.4.5.5 Space Materials Outgassing Chamber

The SMOG Chamber determines material outgassing properties, including the total mass loss. A mass spectrometer is used to identify the species of gases produced by heating a known material to some specific temperature. The mass spectrometer identifies those species which might not condense on a 77 Kelvin (-321°F) surface and would not be detected by a QCM cooled to 77 Kelvin. Outgassing of space components, such as thermal blankets, can be accomplished in larger chambers.

2.3.4.5.6 Characterization of Combined Orbital Surface Effects Chamber

The CCOSE Chamber is used to test the contamination effects of various sources on a small test samples. Testing is typically conducted on 1-in. samples of spacecraft materials. Types of materials include thermal control paints, solar cells, sun-shields, and mirrors.

The CCOSE Chamber, formerly the 4 x 10 Chamber, is a 42-in. diameter by 72-in. stainless steel vacuum shell with bolt-on dished heads on each end and a 4-ft side access port. The pumping system consists of two roughing pumps, a turbopump, a cryogenic pump (cryopump), and a liquid nitrogen cryo-can scavenger. A chamber base pressure of 3.0E-07 torr can be maintained with all pumps in operation. Full pump-down test operation with failsafe monitoring and re-pressurization can be controlled with a single user software input. Space environment simulators include deuterium and xenon lamps to reproduce the ultraviolet (UV) radiation of the sun, atomic oxygen generator, low-energy ion source, proton source, electron source, and a material outgassing cell. The system uses high voltage, hydrogen, oxygen, and nitrogen gases. The high voltage sources are capable of producing a maximum of 100 kV at 2.4 mA.

Raw water and compressed air are used in the operation of the pumps and valves. Gaseous helium and liquid nitrogen are used for cryogenic cooling. Hydrogen is used for operation of the proton gun, oxygen is used in the operation of the atomic oxygen generator, and xenon is used in the operation of the low-energy ion gun. All gases fed into the outgassing cell are collected on cryogenic surfaces or pumped out through the roughing pump.

2.3.4.5.7 1559 Chamber

The 1559 Chamber is based on the ASTM E1559 Material Outgassing Test Standard and is used to evaluate the outgassing properties of spacecraft materials. Test materials include thermal control paints, polymers, and adhesives. Test materials are placed in an effusion cell and heated up to 398 Kelvin (256°F). The 1559 Chamber uses a single roughing pump, a turbopump, and a two-stage commercial cryopump capable of providing temperatures as low as 10 Kelvin (-441°F). Spacecraft material is inserted into the effusion cell during a test, inserted into the vacuum chamber, and held at an elevated temperature for up to five days. Data is collected during this time data from the QCMs to evaluate the rate at which substances are evolved from the space material.

Raw cooling water is used to cool the cryopump. Gaseous helium is recycled in the cryopump system during operation. Substances evolved from spacecraft materials are primarily water, carbon dioxide, and nitrogen. Minute amounts of other condensable gases are collected on the QCMs.

2.3.4.5.8 Ultra-High Vacuum Chamber

The UHV Chamber is used for component checkout. It measures 24 in. in diameter by 36 in. in length and has a cryogenic helium liner that can be cooled to 20 Kelvin (-424°F). The pumping system consists of a turbopump and a roughing pump with a liquid nitrogen cooled baffle (cold trap). The only emissions are nitrogen from the cold trap.

2.3.4.5.9 Vacuum Ultraviolet Chamber

The VUV Chamber was designed to measure the reflectance of mirrors and other optics in the vacuum ultraviolet range. The chamber consists of a single roughing pump and a turbopump. A spectrometer sensitive in the vacuum ultraviolet region is attached to the chamber for mirror and optical evaluation. Recently, the spectrometer system was disconnected and the chamber is now used for component checkouts. The spectrometer system can be re-connected and operational within approximately one week if required.

Hydrogen, xenon, and oxygen gases have been used in this facility to check out the CCOSE proton gun, low-energy ion gun, and atomic oxygen source. A hydrogen supply tank is brought to the unit as needed. A recirculation water bath was used for component cooling. The roughing pump exhausts to the building exterior.

2.3.4.5.10 Component Checkout Chamber

The CCC performs radiometric calibration and characterization for infrared detector and hybrid focal plane arrays (FPA). It can also be used to test materials in a cryogenic environment to study thermal expansion and contraction before testing in the larger test chambers. The relative spectral response of the detector array can be determined as well as hybrid array performance measurements including responsivity, noise, noise equivalent irradiance, uniformity, operability, and dynamic range. The CCC is also used to evaluate mission-related performance elements such as in-band spectral measurements, crosstalk, radiometric flash recovery, and FPA response blooming.

The CCC consists of two concentric circular cylinders with axes aligned vertically. The outer shell of the chamber is a cylindrical, stainless-steel spool section enclosed by elliptical end bells which provide the vacuum enclosure. A mechanical pump and a turbomolecular pump are used to evacuate the CCC. The inner cylinder is a two-piece, gaseous helium-cooled [<25 Kelvin (-415°F)], optically tight liner. The additional cryopumping of the internal liner provides a chamber pressure of less than 1.0E-07 torr. Minimum chamber background is 109 ph/sec-cm2, and a background source is available with a temperature range of 77 to 500 Kelvin (-321 to 440°F). The IR target source temperature can be varied from 200 to 800 Kelvin (-100 to 980°F).

2.3.5 Nuclear Weapons Effect Facilities

The DECADE Radiation Test Facility verifies that space systems, such as satellite surveillance, communication, and missile navigation subsystems, can perform their missions in harsh radiation environments. Test articles in the vacuum chamber are exposed to generated X-rays. Test articles up to approximately 5 ft in diameter by 6.5 ft long can be tested in the vacuum chamber, while larger test articles can be tested at ambient conditions.

The energy required to produce the X-rays is stored in the Marx capacitor banks at the rear of the simulator. The energy is released to diodes that convert the energy to X-rays through the Bremsstrahlung process. Two Bremsstrahlung modes are available to produce X-rays: one producing 40 kilojoules (KJ) of argon radiation with an exposure area of 1 square meter (m2) and dose of 10.7 kilorad (krad) (Si) (plasma radiation source or "cold" mode), and a high dose mode producing 20 krad (Si) over 0.2 m2 (Bremsstrahlung or "hot" mode). The two testing modes are necessary because nuclear explosions produce a broad spectrum of X-rays. The simulator produces up to 40 terawatts (TW) (1.0E12 watts) of power for a period of 40 to 50 nanoseconds (nsec) (1.0E-09 seconds). The DECADE Facility can support up to three shots per day.

The DECADE facility has a vacuum pump system to create the necessary testing conditions within the test chamber. Several aboveground tanks and pumps are used to store and circulate dielectric mineral oil for the X-ray generation equipment. Secondary containment, pumps, and piping are in place at the facility to control the release of any spills or leaks.

A DI water system is used in the DECADE facility for cooling of the capacitor banks, vacuum pump system, and ancillary equipment. Potable water is processed through a series of filters/processes to deionize the water, which is then stored in aboveground tanks. A trench-drain around the perimeter of the facility transfer discharged DI water and any potential releases to a sump. The water in the sump is tested and, upon verification of analytical results, is discharged through an oil/water separator to the stormwater drain system. This stormwater drain discharges to Brumalow Ditch and is conveyed to the ASTF cooling tower basin through the Brumalow Ditch pumpback system.

The DECADE facility includes a radiation safety system of engineering controls to attenuate radiation doses. It also includes a wet-pipe fire suppression system designed for Ordinary Hazard Group 2 in accordance with the National Fire Protection Association (NFPA) 101, Life Safety Code.

2.3.5.1 Modular Bremsstrahlung Source (DECADE Facility)

The MBS is a smaller X-ray simulator within the DECADE Facility used to provide nuclear weapons effects testing on cables and small satellite components. The MBS simulator is used for system generated electro-magnetic pulse, internal electro-magnetic pulse, and also provides enhancement effects testing. A vacuum chamber is available for testing in space environments. The MBS shares the other systems in the DECADE facility.

2.3.6 Airbreathing Propulsion Altitude Test Assets

The Propulsion Altitude Test Assets support aircraft, and missile propulsion system research and development by conducting simulated flight tests over a wide range of Mach numbers and altitudes, which provide data at precisely controlled conditions required to determine operational characteristics of aeronautical propulsion systems. Testing includes the evaluation of air-breathing engine performance, engine/inlet dynamics, engine operability transients, engine aeromechanical behavior, engine mission simulations, ice accretion, engine durability or altitude accelerated mission testing, and altitude performance.

Test assets fall under two primary divisions:

- Propulsion Development Test Assets: J-1, J-2, T-1, T-2, T-3 T-4, T-5, T-7, T-11, T-12, SL-1, SL-2, SL-3, C-1, and C-2.
- Combustion Research Assets: R1A1, R1A2, R1D, R1E, R2A2, and R2H.

The Propulsion Altitude Test Assets are supported by three plant assets which include air supply and/or exhaust systems: the ETF-Basic (ETF-B Plant), the ETF-Addition (ETF-A Plant), and ETF-C Plant, commonly referred to as the ASTF. These support facilities are discussed in detail in Section 2.4.

2.3.6.1 Propulsion Development Test Assets

The propulsion development test assets perform studies on air breathing engines, which include turbine and ramjet engines. Instrumentation is attached to jet engines, which are then installed in test assets, mounted on thrust stands. Tests are sometimes performed with screens placed in front of the engines to simulate airflow characteristics of the aircraft inlet or with water atomizing systems to simulate icing conditions. The engine is then operated as the air supply compressor and exhauster systems are regulated to simulate flight conditions with controlled airflow rate, temperature, pressure, and velocity as required. Instruments are installed in and around the engine to measure forces, pressures, temperatures, vibrations, and other parameters. Testing conditions are specific to the required flight envelop including the critical areas representing the engine performance limits, which are generally less than Mach 3.8 and altitude less than 100,000 ft. Table 2-2 summarizes the characteristics of the propulsion test assets.

Table 2-2. Summary of the Propulsion Development Test Assets

Test Asset	Test Section Dimensions		Mach Range	Mass Flow (lb/sec)	Inlet condition	
	Diam/Width x Height (ft)	Length (ft)			Pressure (psia)	Temp (F)
J-1	16	44	0 to 3.2	550	120 40	-60 to 720
J-2	20	46	2.6	550	40	-60 to 450
T-1	12.3	39 to 57	2.6	470 650 800	70 60 40	-40 to 400
T-2	12.3	32 to 50.5	2.6	470 650 800	70 60 40	-40 to 400
T-3	12	15	0 - 4	150 200	120 260	-85 to 1,200
T-4	12.3	39 to 47.8	2.6	40 650 800	70 60 40	-40 to 400
T-5	7	17	0 - 2	20	75	-65 to 200
T-7	7	9	0 - 3	20	40	-65 to 650
T-11	9.5 x 9.5	17	NA	67	35	-65 to 230
T-12	10	20	NA	67	35	-65 to 230
SL-1	24 x 24	56	0	1,000	14.7	ambient
SL-2 SL-3	24 x 24	60	0-1.2	550	14.7 to 38	20 to 270
C-1	28	45	0 – 2.3	1,500	130	-40 to 350
C-2	28	47	0 – 2.3	2,200	40	-40 to 350

2.3.6.1.1 Test Asset J-1

Propulsion development test asset J-1 is used for testing of complete turbojet/turbofan propulsion systems. It is primarily used for direct-connect performance and stability testing of large air breathing propulsion systems, although free-jet testing can be accommodated. A typical installation includes inlet airflow measuring venturis, an 8-ft-diameter inlet plenum, engine, and exhaust collector or diffuser. High accuracy measurement systems for thrust, pressure, flow rates, temperature, and speeds are available in the J-1 test complex for the accurate determination of engine performance.

Test asset J-1 receives process air from the ETF-C Plant. The J-1 inlet plenum is provided conditioned air using gas fired heaters for heated air and expansion turbines for cold air. True simulated flight conditions can be provided over the entire flight envelope of most turbojet engines up to Mach 3.2 and 75,000 ft, either in a free-jet or direct-connect test configuration using the ETF A&B Plant exhaust compressors. Ejector-diffusers can be used to simulate higher altitudes in the test asset.

Exhausts first pass through spray cooler/scrubber units to cool the gases and remove some of the components upon discharge from the test unit. The exhaust is then discharged to atmosphere or is pumped through the ETF A-Plant exhaust compressor system and then to atmosphere or into the B-Plant exhaust compressor system for discharge to the atmosphere. The gases pass through another spray cooler/scrubber upon discharge from the A-Plant exhaust compressors before final discharge to the atmosphere. Cooling water from the J-1 spray cooler/scrubber and the A-Plant exhaust spray coolers/scrubber flows to the A-Plant barometric well while the cooling water from the B-Plant exhaust spray coolers/scrubbers flows to the B-Plant barometric wells. The water from both barometric well systems is skimmed to separate any petroleum components removed from the exhaust, tested, and then pumped to the cooling water return system. Exhausting of gases can be augmented by the PWT PES.

2.3.6.1.2 Test Asset J-2

Test Asset J-2 is used primarily for direct connect performance and stability testing of large air-breathing-type propulsion systems. In addition J-2 has the basic capabilities for free-jet testing of inlets, engines, and other aerodynamic shapes. Simulated pressure altitudes up to 75,000 ft can be provided in the test by the ETF A & B Plant exhaust compressors. Higher simulated altitudes maybe attained in the test asset by the use of ejector-diffusers. The process air, exhausting of gases, and cooling water for J-2 are the same as described for J-1.

2.3.6.1.3 Test Asset T-3

Test Asset T-3 is a high-temperature, high-pressure, small air-breathing propulsion test asset simulating altitudes up to 100,000 ft. Test articles up to 16 in. in diameter and 6 ft in length can be mounted to the thrust stand installed in the test asset. The test asset is equipped with a 250-gallon batch fuel system for use with hydrocarbon fuels. An additional 1000-gallon make-up tank is also available to supplement the 250-gallon tank. The fuel can be conditioned from -65°F to 200°F. The test asset contains pressure, temperature, flow, strain, and vibration instrumentation consistent with turbojet engine testing. Inlet air is available from the ETF-C Plant and for higher temperature/pressure requirements, the airflow to the asset can be augmented by the VKF Plant. The evacuation of exhaust gases and cooling water return are the same as described for T-4.

2.3.6.1.4 Test Asset T-4

Direct-connect tests of air-breathing propulsion systems can be performed in Test Asset T-4 at simulated altitudes up to 75,000 ft. The process air supplied to the T-4 test asset is the same as that for the J-1 test asset. The exhaust gases from the "T" test assets are pumped through the B-Plant exhaust compressor system for discharge to the atmosphere. The exhaust gases first pass through a spray cooler/scrubber unit to cool the gases and remove some of the components of the exhaust gas upon discharge from the test unit. The gases pass through another spray cooler/scrubber upon discharge from the B-Plant exhaust compressors before final discharge to the atmosphere. Exhaust gases can also be exhausted through the PWT PES. Cooling water from the B-Plant exhaust spray coolers/scrubbers flows to the B-Plant barometric wells and is then pumped to the cooling water return system.

2.3.6.1.5 Test Asset T-11

Test Asset T-11 was designed for small air-breathing propulsion system tests at altitudes from sea level to 50,000 ft. The asset can be used for small turbojet, turbofan engines up to 2 ft in diameter. Capabilities include development test, air start, cold starts, mission simulation, and performance verification tests. Smoke/emissions data can be collected during testing. Systems are available for test article and fuel system temperature conditioning (-65°F to 176°F), simulated air-launched starts, inlet total-pressure distortion, power extraction, and computer-controlled mission simulation tests. The systems for air supply, evacuation of exhaust gases, and cooling water return are the same as described for T-1.

2.3.6.1.6 Sea Level Test Asset SL-1

Test Asset SL-1 provides turbine engine testing for sea level inlet and exhaust. Testing can include post-overhaul engine testing and endurance, emissions, and performance/development testing. It is a stand-alone, Air Force A/F32TR-9 Noise Suppression System ("Hush House") that has no connections to the air-side or exhaust plant; ambient air is taken into the inlet. Test fuels are supplied by tank or truck. Exhaust from the combustion of jet fuel is mixed with bypass process ram-air and vented directly to the atmosphere through a vertical stack in accordance with the Title V air quality control permit conditions.

The residual noise environment while operating these engines is no higher than 77 dB at 100 m from any point on the suppressor when measured at 4 ft above ground level. Engine controls are contained in a road-able control cab sited adjacent to an engine-viewing asset window. Available operating instrumentation (approximately 40 channels) has monitoring capability (only) in the control cab.

2.3.6.1.7 Sea Level Test Assets SL-2 and SL-3

Trenton Sea Level Test Assets SL-2 and SL-3 provide engine endurance testing (accelerated mission testing) and corrosion testing of turbofan/turbojet engines. These test assets provide either ambient/heated atmospheric inlet air or process inlet air. They share a steam heater and are interconnected with the ETF-C Plant to provide pressurized inlet conditions as required. SL-2 and SL-3 provide only atmospheric exhaust conditions in which the exhaust from combustion of jet fuel is mixed with bypass process ram-air and vented directly to the atmosphere through a vertical stack in accordance with the Title V air quality control permit conditions. The exhaust silencer is air-cooled and can accommodate both fixed and vectoring engine exhaust nozzles. Exhaust spray water for acoustic dampening is available

2.3.6.1.8 Test Assets C-1 and C-2

Propulsion Development Test Assets C-1 and C-2 provide developmental, certification, and qualification testing of large air-breathing engines. Both assets can be equipped with an exhaust gas management system providing exhaust collection for two-dimensional vectoring exhaust nozzles through movable, water-cooled doors and side vanes. Two hydrocarbon fuel systems can supply up to 550 gpm of fuel conditioned between ambient temperature and 300°F to either test asset. Test article and equipment access is provided by 36-ft-long sliding hatches. The test assets are monitored for up to 2,000 measurements, including temperature, pressure, fuel flow, thrust, and vibration.

Properly conditioned air is delivered to the test assets from the ETF-C Plant air compressors through an array of dryers, coolers, and heaters to produce the desired temperatures, pressures, velocities, and flow rates simulating flight conditions. Test Asset C-1 was designed for performance and operability testing of large augmented turbojet engines, although free-jet testing can be accommodated. The asset has a 22-ft-diameter inlet plenum. Exhaust from the C-1 test asset is processed through a spray cooler to reduce the gas temperature and is then vented either through a vertical atmospheric exhaust stack and silencer or through first-stage, second-stage, and/or third-stage exhauster systems and spray coolers for discharge through a vertical stack and silencer. Use of the multiple exhausters depends on the required test conditions. Each exhauster stage consists of multiple compressors and a cooler.

Test Asset C-2 was designed for performance testing of large turbofan engines. The 30 ft. diameter asset inlet plenum is offset below the asset center to accommodate the installation and actuation of free-jet nozzles for aerodynamic testing. Airflow is provided by the ETF-C Plant air supply compressors and can be augmented by supplementing the compressor air with atmospheric in-bleed air (for subatmospheric inlet pressures). Test Asset C-2 also has free-jet test capability. An icing system that utilizes up to 199 atomizing spray nozzles in a 125-in. inlet spool is available for installation inside the test asset in the engine inlet system. Icing clouds can be provided over a wide range of liquid water content and droplet sizes with uniform distribution across the flow plane of interest. The exhaust system is the same as that described for the C-1 test asset.

2.3.7 Space Propulsion Test Assets

The rocket development test assets fire liquid and solid propellant rocket engines at simulated altitudes, which are created by pump-down of the test assets to near vacuum conditions. Solid or liquid oxidizers are provided for rocket ignition. The exhaust gases are cooled with spray water, which also scrubs out the condensable fraction of the exhaust gases. The remainder of the exhaust gases is re-pressurized using compressors and discharged to the atmosphere.

2.3.7.1 Test Asset J-6

Test Asset J-6 is a horizontally arranged test asset designed for static testing of large solid propellant rocket motors with up to 500,000-lb thrust at simulated pressure altitudes of 100,000 ft. A multi-component thrust measuring system provides precision ballistic data capability. J-6 measures 26 ft in diameter by 62 ft in length. Test Asset J-6 is a remotely located facility for the testing of detonable solid-propellant rocket motors with up to 80,000 lb of propellant without introducing risk to other AEDC facilities. Its location minimizes the overpressure risk to other AEDC facilities, and a concrete blast wall provides protection from potential debris. J-6 can support long-duration altitude performance tests of solid propellant rocket motors and can be used to test many different types of motors with either large quantities or advanced mixes of propellants. Figure 2-7 shows the conceptual flow for J-6 operation.

The temperature-conditioning system using gaseous nitrogen can maintain the test asset air temperature at a prescribed temperature within the range of 15°F to110°F from motor installation until prefire pumpdown to altitude conditions. Dry gaseous nitrogen is available outside of the facility from 792,000-scf of storage capacity at 4,750 psi. Initial pumpdown and post-test evacuation is provided by the ETF exhaust system. Pressure altitudes at less than 0.1 psia are achievable through special pumping equipment available, and can be maintained over long periods. An annular steam ejector with flow rates up to 3,000 lb/sec and a water-cooled diffuser system are used in conjunction with the 4.5 million-ft^3 storage volume of the dehumidification cooler (250-ft-diameter by100-ft-high concrete vacuum chamber) to provide pre- and post-test altitude simulation and to minimize recirculation during motor tail off. High-pressure steam supplied by Steam Plant C is stored in high-pressure steam accumulators adjacent to the facility. The J-6 main steam ejector is supplied by steam from six 750 psi high pressure accumulators of 10,300 ft^3 volume each.

Exhaust gas cooling/scrubbing is provided by 70,000-gpm water spray cooling in the saturation cooler and up to 1-million-gpm water (five-level) spray cooling in the dehumidification cooler. Discharge of the rocket exhaust gases from J-6 is conditioned under the Title V air emission permit.

Three rocket diffusers are available for positioning at the discharge end of the test asset to provide altitude simulation during the rocket firing. These interchangeable rocket diffusers encompass a thrust range up to 500,000 lbf with a cooling water flow rate ranging from 28,000 to 40,000 gpm. The test asset is equipped with hydraulic and pneumatic services. Cooling water from J-6 is discharged through a cooling water return ditch directly to the retention reservoir.

2.3.7.2 Aerodynamic and Propulsion Test Unit (APTU)

The APTU is a blowdown-type facility designed primarily for high speed air breathing (ramjet) propulsion system testing. The facility's capabilities also support true temperature aerodynamic and high-temperature materials tests. APTU is operated at Mach numbers from 2.2 to 8.0 at simulated altitudes ranging from 5,000 to 120,000 ft. Figure 2-8 shows the conceptual flow for APTU operation.

Propulsion testing is the primary purpose of APTU, and the facility is capable of testing both liquid- and solid-fueled ramjets and scramjets. A broad capability of pressure (static and dynamic), temperature, and thrust stand measurements allows very detailed measurements. The facility is also suited for aerothermodynamic tests since true temperatures at altitude can be simulated over a range of Mach numbers. The facility can also be used for material evaluation tests, supplementing the VKF Aerothermal Tunnel C capability.

APTU consists of a combustion air heater (CAH) with a mixing vessel, a 7-ft diameter stilling chamber, and a test asset 16 ft in diameter and 45 ft long. The airstream is discharged directly to atmosphere through a 4- or 5-ft-diam, 42-ft-long, segmented exhaust connector followed by a 6-ft-diam, 40-ft-long diffuser and spray cooler.

2.4 Plant Assets

The Plant Assets at AEDC include: ETF – Basic Plant, ETF-Addition, PWT (including PES), VKF, ASTF(ETF – C Plant), Chambers, Helium Storage Facility, and the Nitrogen storage, conversion, and distribution systems.

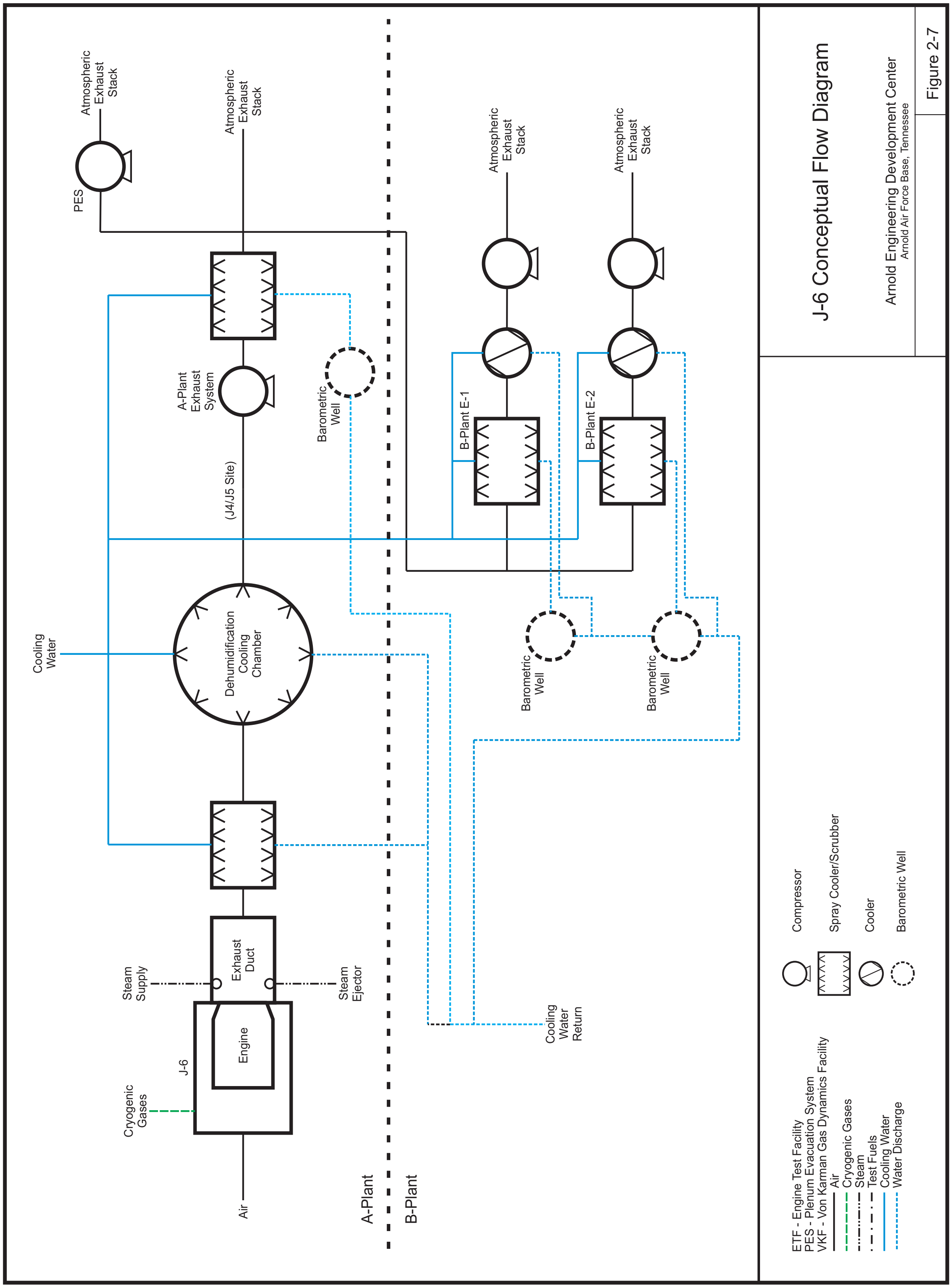


Figure 2-7. J-6 Conceptual Flow Diagram

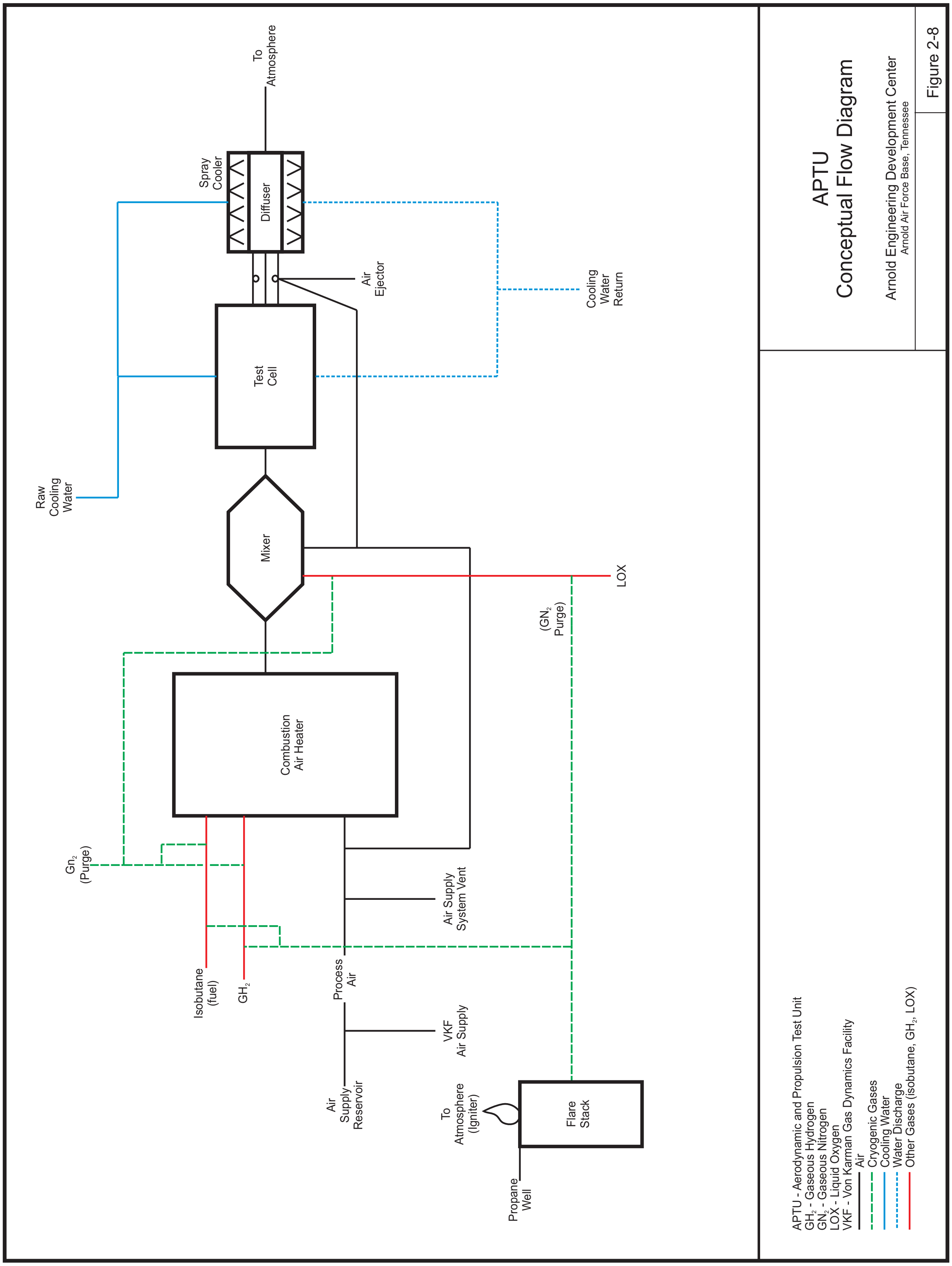


Figure 2-8. APTU Conceptual Flow Diagram

The ETF-A/B/C Plants are interconnected and support all of the altitude test assets and six research assets to achieve desired test conditions. While the “J” test assets are located within the ETF-A Plant region and the “T” test assets are located within the ETF-B Plant region, the ETF-A/B/C Plants are interconnected to support operations at all ETF-A and ETF-B facilities. The ETF-A/B Plants are also connected to the PWT and VKF. The VKF is used to provide high-pressure air and the PWT PES is used to augment the exhaust gas pumping in the ETF-A/B Plants. The ETF-B Plant is also used to provide conditioned air to the PWT. The ETF-C Plant supports the C-1 and C-2 test assets as well as providing ram air for the Large Engine Testing Facility, which houses the SL-2 and SL-3 test assets. Figures 2-9 show the conceptual flow concept for AEDC plant assets.

2.4.1 ETF A/B Plants

The ETF-B Plant air supply system consists of four centrifugal-flow air supply compressors and six centrifugal-flow exhaust compressors totaling 52,000 horsepower. Refrigeration is used to condition the air supplied to the various test assets. The ETF-B Plant has a total of 2,670 tons of continuous mechanical refrigeration. The ETF-A Plant air supply system has been decommissioned and the refrigerant has been removed.

There are two separate exhaust systems within the ETF-A/B Plant complex. The ETF-B Plant system consists of six centrifugal-flow exhaust compressors, and ETF-A has two axial-flow exhaust compressors. The two systems are interconnected to provide operating flexibility. Exhaust capacity for the “J” assets is provided by the ETF-A exhaust system or by the ETF-A and ETF-B systems in series. Exhaust capacity for the T-Assets is provided by the ETF-B exhaust system. Interconnecting ducts to the PWT PES exhaust compressors allows augmentation of exhaust capability for ETF-A and ETF-B test assets.

Each of the propulsion test assets is equipped with an exhaust cooler, which is supplied water by the AEDC raw cooling water system. The water flow rates typically required coupled with scheduling of testing of other water-consuming operations at AEDC allow extensive testing durations for these assets. Potable water may also be used for lesser flow rates such as for electronic equipment or instrumentation cooling.

Test Assets T-1, T-2, T-3, T-4, T-5, J-1, and J-2 and the research assets are equipped with hydrocarbon (jet fuel) service from a central fuel tank supply. All power supply for operation of the equipment is supplied through the ETF electrical distribution and substation. Figure 2-10 shows the conceptual flow for the ETF A/B plants.

2.4.2 Aeropropulsion System Test Facility (ASTF) – (ETF-C)

The ETF C plant air supply system is comprised of six axial-flow air supply compressors. The compressors are arranged in stages such that four first stage and two second stage powered by four 27,500 hp and two 52,500 hp synchronous motors can deliver 2750 lbm/sec at the design point. The ETF-C exhaust system is comprised of 12 identical axial-flow exhaust compressors. Each exhauster is rated at 1,000,000 cfm. The exhaust compressors are arranged in stages such that there are eight first stage axial flow compressors, three second stage axial flow compressors, and one third stage axial flow compressor. These compressors are powered by eight 27,500 hp synchronous motors and four 44,000 hp synchronous motors. The compressor drive synchronous motors are sequentially started by two variable frequency starting systems, enabling the plant to be brought on line quicker than using induction starting motors. In addition, the process air supply ducting is fabricated of stainless steel or stainless cladding to minimize contaminants.

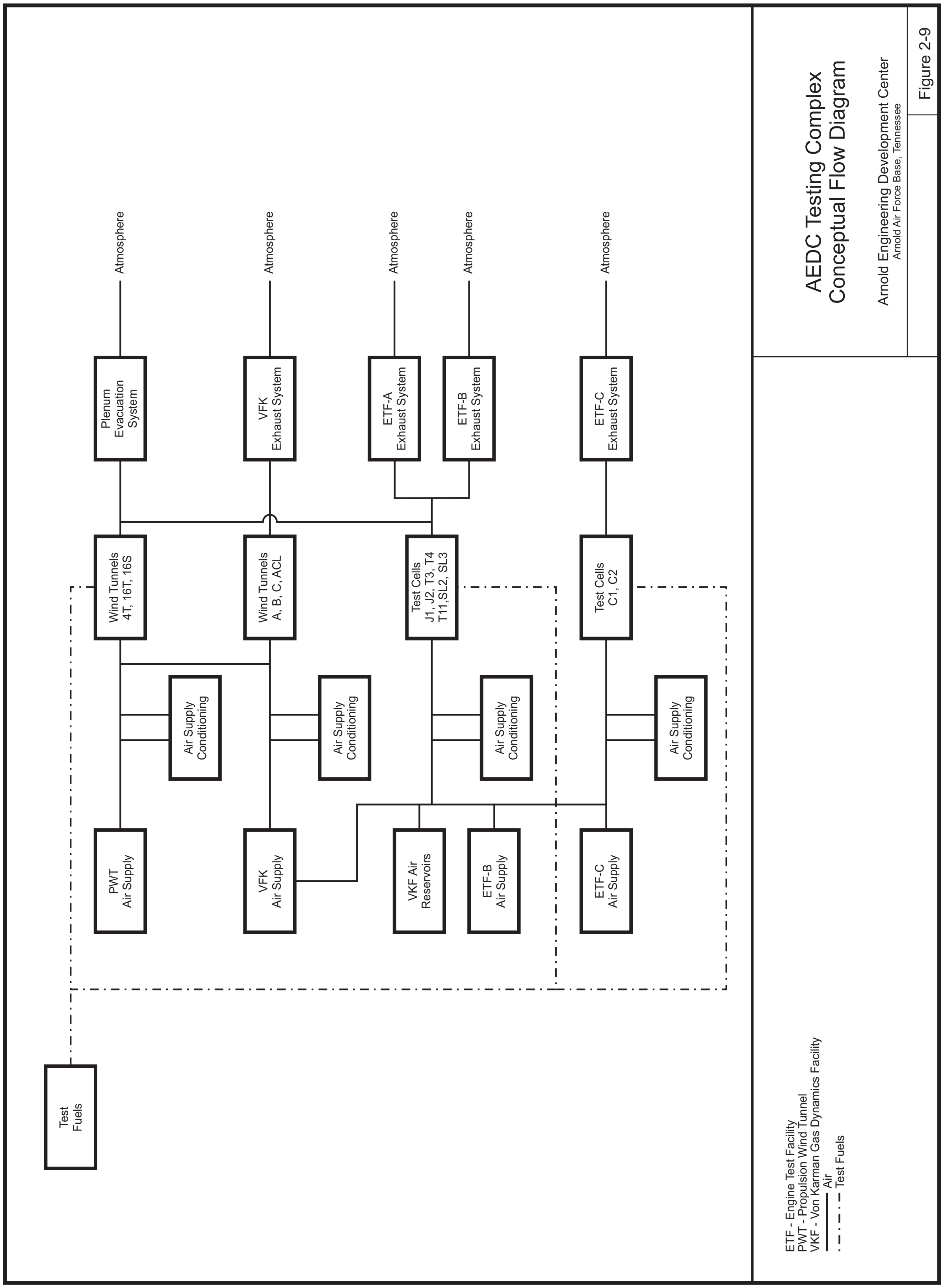


Figure 2-9. AEDC Testing Complex Conceptual Flow Diagram

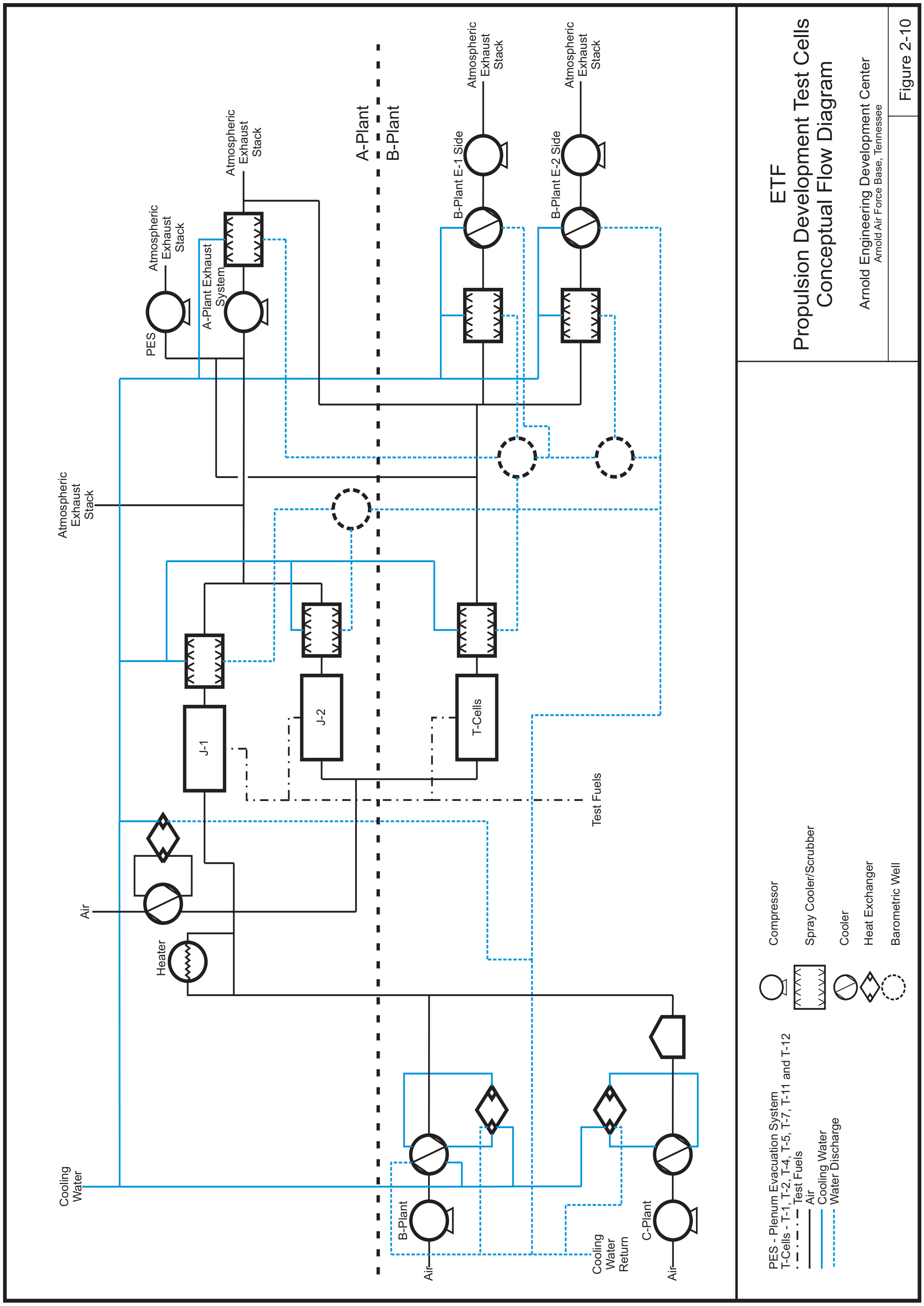


Figure 2-10. ETF Propulsion Development Testing Cells

Refrigeration is used to condition the process air supply. Two process air coolers provide 15,400 tons of refrigeration. A third cooler, designed for conditioning atmospheric (inbleed) air to Test Asset C-2, has 7,000 tons of refrigeration.

2.4.3 Propulsion Wind Tunnel (PWT)

The PWT drive system with a maximum total capacity of 328,000 hp is used to drive the compressors for both Tunnels 16T and 16S. It consists of four synchronous motors. Disconnect couplings permit the four motors to be operated with either the Tunnel 16T compressor or the Tunnel 16S compressor.

The Tunnel 16T compressor, which normally operates at a constant speed of 600 rpm, is a three-stage, axial-flow machine having a 30-ft tip diameter and a hub-to-tip ratio of 0.6. The inlet guide vanes and the three interstage stator rows of the compressor are remotely controllable through an angle range that satisfies the range of volume flow requirements. Subsynchronous, variable-speed operation is possible using the 60,000 hp synchronous motors. Operating the compressor in this manner extends the tunnel operating range to low subsonic Mach numbers.

The main compressor of Tunnel 16S consists of four axial-flow compressors (barrels) which are oriented so that any number from one to four barrels may be operated in series. The number of barrels operating in series is controlled by a system of iris valves and disconnect couplings located between each barrel. The compressor operates at a constant speed of 600 rpm with volume flow and pressure ratio adjustment provided by the remotely controlled inlet guide vanes and stator blades of the first, second, and third barrels. The first three barrels are four-stage, axial-flow compressors, and the fourth, a six-stage compressor

The PWT Plenum Evacuation System (PES) is composed of two identical groupings or increments of compressors, drive equipment, and associated ducts and valves. Each increment has five Allis-Chalmers VA-1409 compressors, which are nine stage-axial-flow machines, and one Allis-Chalmers VA-1107, which is a seven-stage axial-flow machine. The arrangement of the ducts and valves of each increment permits the compressors to be operated in one-, two-, or three-stage compressor configurations.

The VA-1409 compressors are each rated at 4,620 cfs (measured at 100°F) at a design pressure ratio of 3.3, and the third-stage VA-1107 compressors have a design point of 1,250 cfs (100°F) at a pressure ratio of 2.0. The compressors operate at a constant speed of 3,600 rpm. All compressors have inlet guide vanes that are remotely controllable through an angle range of ±15 deg from design conditions.

The compressors are driven in groups of two by a common drive system; resulting in a total of three drive groups for each increment. Two groups consist of two VA-1409 compressors driven in tandem by a 28,500-hp synchronous motor, and one group of one VA-1409 and one VA-1107 is driven in tandem by a 14,000-hp synchronous motor. The synchronous motors are powered from a Variable Frequency Power System (VFPS). The total drive power of each increment is 71,000 hp at 100-percent rated load; however, a continuous service factor of 15 percent provides an available power of 80,650 hp. Figure 2-11 shows the conceptual flow for the PWT plant.

2.4.4 Von Kármán Facility (VKF)

The VKF main compressor system is comprised of six axial and seven centrifugal compressors arranged in nine stages. These machines are arranged into five groups, each of which is powered by a 16,000-hp synchronous motor and a 2,500-hp wound-rotor motor for a total installed horsepower of 92,500. The first stage is rated at 600,000 cfm inlet with a minimum inlet pressure of 0.25 psia.

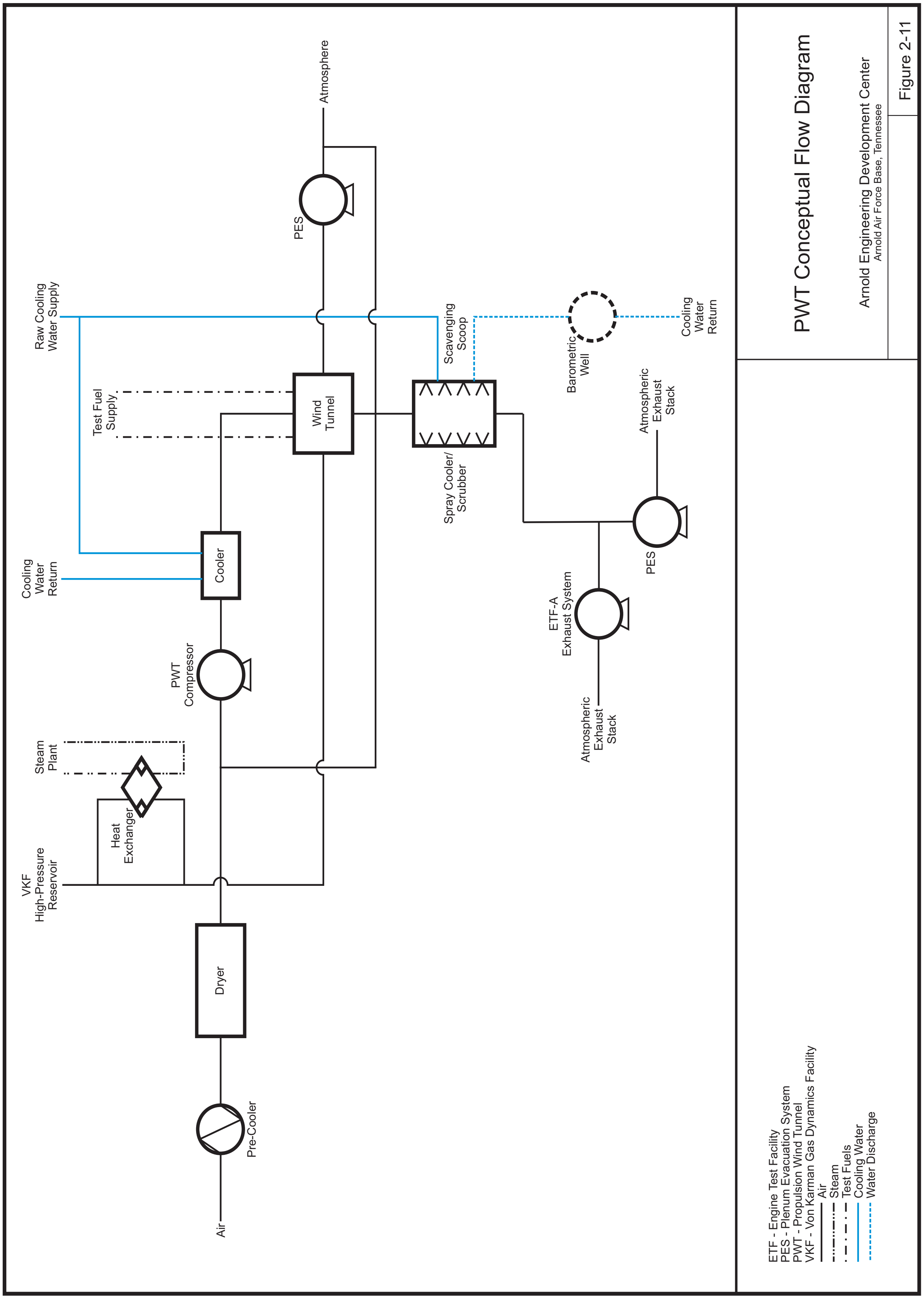


Figure 2-11. PWT Conceptual Flow Diagram

The compressors are interconnected by a duct and piping system which includes intercoolers and valves whereby one to five stages are used to deliver air to Tunnel A for operation between Mach numbers 1.5 and 5.5. Five stages are used to deliver air to Tunnel B for operation at Mach 6, seven stages for Tunnel B Mach 8 operation, and 7 or 8 stages are used to deliver air to Tunnel C for operation at Mach 8 or 10. Either seven or nine stages are used for Aerothermal Tunnel C at Mach 4, depending on the required temperature and pressure.

The VKF high pressure addition provides the capability for air to be stored in a 29,770-ft3 storage system at pressures up to 3,800 psia. This system is composed of the 7,550-ft3 VKF storage reservoir and the 22,200-ft3 APTU storage facility. The maximum capacity of the combined storage system is approximately 542,000 lb of air.

An auxiliary compressor system is capable of charging the storage system at the rate of 6.0 lb/sec. In addition to the main compressor system, a two-compressor system comprising the tenth and eleventh stages of the main plant can be used to charge the storage reservoirs at the rate of 84 lb/sec at 3,800 psi. The two-compressor system is powered with a 7,000-hp induction motor. Figure 2-12 shows the conceptual flow for VKF plant.

2.4.5 Chamber Plant

The helium refrigeration system is made up of a 3-kw refrigerator and a 0.5- kw and 1-kw helium liquefaction system. The refrigerators and liquefaction systems are integrated to provide operating flexibility. The 3-kw refrigerator can supply the chambers or the helium liquefiers with gaseous helium at 10 K. The 0.5-kw gaseous helium refrigerator primarily supports the Research Lab chambers that include the Focal Plane Characterization Chamber, several research chambers, and contamination chambers. This unit has a more rapid startup time than the larger refrigerators, thus providing extremely flexible operation of the smaller chambers. The 0.5-kw refrigerator can produce 35 liters/hr of liquid helium. The 1-kw refrigerator is dedicated to the production of liquid helium at 80 liters/hr. All of the test chambers and helium refrigerators are connected to the closed-loop, high-pressure helium distribution system.

2.4.6 Central Nitrogen Storage and Distribution System

The Central Nitrogen Storage Facility consists of five liquid nitrogen dewars. Liquid nitrogen can be used for testing and also piped to one or both gas to liquid conversion facilities. Gaseous nitrogen is stored in 23 high pressure storage vessels (5,000 psi) and provides a capacity of 5,280.7 cubic feet. There is approximately 13,750 feet of piping associated with this system.

2.4.7 Central Helium Storage Facility

The Central Helium Storage Facility consists of twelve high pressure storage vessels (5,000 psi) and provides a capacity of 2,560.4 cubic feet. There is approximately 1,000 feet of piping associated with this system.

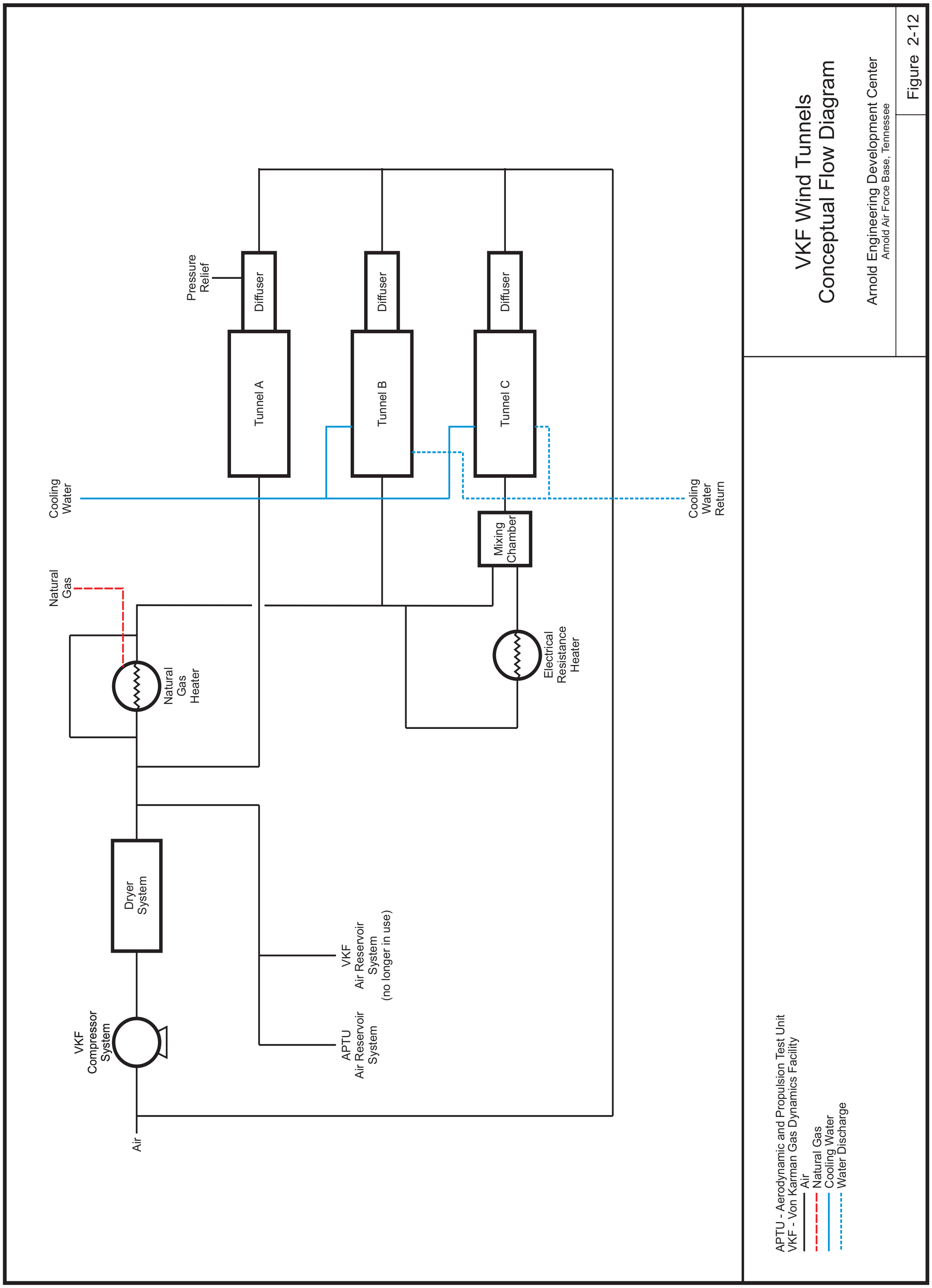


Figure 2-12. VKF Wind Tunnels Conceptual Flow Diagram

2.5 Description of the Alternatives

The section describes the Proposed Action and the No Action alternative. The criteria for alternative evaluation and comparison for this EA are provided below.

1. Provide the USAF sufficient testing capability to ensure continuing air and spacecraft technological superiority. Testing facilities must be able to accommodate full-size rocket and air-breathing engines and appropriately sized models, and duplicate conditions from sea level to the uppermost atmosphere and near space.

2. Provide adequate control for classified and other confidential information that might compromise the security of the United States if it became available to potentially hostile foreign nations or terrorists.

3. Avoid major and substantial environmental impacts.

4. Represent reasonable economical viability.

Baseline conditions common to the No Action and Proposed Action alternatives include infrastructure and support facilities, safety, health and environmental management systems, and testing operations, described in this EA. The Proposed Action and the No Action alternative are differentiated by the level of testing that would take place in the future. The primary distinction between these two alternatives is that the Proposed Action allows much greater flexibility for AEDC to meet future testing needs.

2.5.1 No Action Alternative

Under the No Action alternative, current testing operations would continue but there would no significant increase in test frequency or facility operations. Testing of newly acquired systems could be conducted, but only those accommodated by existing facilities; only routine maintenance and repairs would be conducted to support continued operations. Increased operations to meet the changing needs of AFMC's military and commercial clients would not be conducted under the No Action alternative.

2.5.2 Proposed Action

The Proposed Action for AEDC testing is to expand and enhance capabilities to meet current and future needs of AFMC's military and commercial clients. Existing facilities would be operated at the maximum capacity allowable by the current permit limits. As under the No Action alternative, consolidation of operations would be used as appropriate to improve infrastructure efficiency.

2.6 Comparison of Alternatives

Comparison of the Proposed Action and No Action alternative is presented in Table 2-3. Potential impacts to the affected environment are addressed in detail in Section 4, *Environmental Consequences*.

Table 2-3. Comparison of Alternatives, AEDC Mission EA

Proposed Action		No Action
Natural Environment		
Geomorphology	No significant impact.	No additional impact.
Water	Cooling water usage would increase with increased test hours. Since the water is used primarily for non-contact cooling, no impacts to water quality or wetlands are anticipated. No groundwater usage would be required and no impacts to groundwater quality expected. No significant impact.	No additional impact.
Air	Air emissions would increase relative to increased air-breathing propulsion altitude test asset operation. There would be a potential impact from release of unburned hydrocarbons during engine testing, combustion by-products from boilers, heaters, and dryers, and other miscellaneous sources. However, emissions would be limited by the conditions established in the Title V Major Source Operating Permit. No significant impact.	No additional impact.
Biological Resources	Impacts to biological resources, including sensitive habitats and rare, threatened, and endangered species, are not anticipated from activities on the already disturbed industrial area where limited natural habitat remains. Increased operations would be consistent with present conditions, with limited potential for impact to biological resources on the adjoining lands outside of the industrial area. Current conservation and integrated ecosystem management would continue. No significant impact.	No additional impact.
Human Environment		
Socioeconomics	No impact to socioeconomics is anticipated because operations would continue both for the near term and long term. No significant impact.	No additional impact
Cultural Resources	No impact to cultural resources is anticipated because all activities would be limited to the already developed industrial area and any facility changes would be conducted in accordance with the IBCRMP and coordination with the SHPO.	No additional impact
Land Use	No change to land use is anticipated as the AEDC mission would remain consistent with present conditions and large land buffers would remain. No significant impact.	No additional impact
Utility Infrastructure	The utility infrastructure would remain in place with no significant change in overall system load over the near or long term. No significant impact.	No additional impact

Proposed Action		No Action
Occupational Health and Safety	Adherence to OSHA requirements and AEDC's comprehensive safety program would continue. No significant impact.	No additional impact
Hazardous Materials and Waste	No changes are anticipated to the use of HAZMAT or wastes generated for the near term. Ongoing pollution prevention measures may continue to reduce the use of HAZMAT and generation of hazardous waste over the long term. No significant impact.	No additional impact
Transportation	No change to transportation as existing systems could accommodate any reasonably expected changes in traffic from future operations. No significant impact.	No additional impact
Noise	No change in impacts from noise over the near or long term. Noise levels in the surrounding communities would not exceed 65 decibels (dBa) during testing and elevated noise levels would be intermittent and temporary. Temporary and intermittent construction and demolition-related noise would be generated, but levels would be less than most testing operations. Worker hearing is protected through adherence to the safety program. No significant impact.	No additional impact

3.0 AFFECTED ENVIRONMENT

This section describes environmental baseline conditions at AEDC and the surrounding areas. Although some of the sections have been excluded from consideration, the information is useful in understanding the setting in which AEDC operates. For many environmental concerns, the region of influence (ROI) is limited to the AEDC industrialized complex; therefore, biological and cultural issues will not be affected beyond the current conditions. However, for some resources such as air and water quality, the ROI can extend beyond the facility boundaries and these resources will be evaluated in detail to determine environmental impacts.

3.1 Natural Environment

This section describes the affected natural environment, including water, air and biological resources.

3.1.1 Water

Hydrological features include lakes, rivers, streams, springs, floodplains, wetlands, and groundwater. Figure 3-1 shows the surface water features for Arnold AFB.

3.1.1.1 Surface Water

A southwest-northeast trending surface water divide bisects Arnold AFB and the AEDC industrialized area. This divide separates the Duck River watershed to the north from the Elk River watershed to the south. The Duck River basin receives drainage from Hunt, Huckleberry, Wiley, Crumpton, and Bobo Creeks and the Hickerson Spring Branch. The Elk River basin receives drainage, primarily from Bradley, Brumalow, and Rowland Creeks. Smaller creeks such as Dry Creek, Hardaway Branch, Saltwell Hollow Creek, Spring Creek, and Poorhouse Creek also contribute to the Elk River watershed (Call 2003). The predominant surface water feature at the base is Woods Reservoir, a 3,980 acre lake on the Elk River that was constructed to support AEDC operations. The reservoir is also used for recreational activities such as swimming, boating, fishing and camping.

The headwaters of several streams have been extended through ditching into the AEDC complex to receive discharge water from testing facilities This includes Rowland Creek, which has been extended across the natural drainage divide into AEDC. The retention reservoir was constructed at the headwaters of a tributary to Crumpton Creek and drains through engineered gates across the natural divide to the ditched portion of Rowland Creek and subsequently into Woods Reservoir (Robinson and Haugh 2004).

Storm drainage for most of the base is overland flow to natural drainage, creeks, and ponds. Surface waters in the northern portion of the base within the Duck River basin flow to Duck River and to Normandy Lake. Waters in the southern portion of the base within the Elk River basin, including most of the AEDC complex, drain to Woods Reservoir and the Elk River. Stormwater runoff within the AEDC complex area is collected through a network of overland flow, open drainage ditches, and underground storm mains. Rowland, Bradley and Brumalow Creeks carry stormwater from the south to Woods Reservoir. Crumpton Creek drains a small area to the north of the main industrial complex and flows into the Duck River basin.

Floodplains, including those areas that lie within the 100-year floodplain established by the Federal Emergency Management agency (FEMA), have been defined at several locations on Arnold AFB (Figure 3-1). Portions of the base that lie within the 100-year floodplain include the inlet to Woods Reservoir on the south side of the base, Huckleberry and Hunt Creeks on the north side of the base near the city of Manchester, and a small area where Bobo Creek exits the base near the city of Tullahoma. The developed portions of base, including the AEDC complex and family housing areas, do not experience flooding problems.

Through the CWA 303(d) list, the EPA identifies streams and lakes that are water quality limited or are expected to exceed water quality standards and need additional pollution controls. They are considered impaired by pollution and not fully meeting designated uses. Once a surface water body has been placed on the 303(d) list, it is considered a priority for water quality improvement efforts. These efforts include traditional regulatory approaches such as permit issuance as well as efforts to control pollution sources that have historically been exempted from regulations such as certain agricultural and forestry activities.

Within the Duck River basin, the Duck River and the Little Duck River have been determined to not fully meet their designated uses. Both have elevated bacteria levels near the City of Manchester, attributed to failing sewage collection systems within the city and general urban runoff (CH2MHILL 2005a, TDEC 2002b). The Upper Elk basin has 12 water bodies on the final version of the 2002 Section 303(d) list, which was issued in January 2004 (USEPA 2004). Woods Reservoir is listed as not supporting its designated uses because of polychlorinated biphenyl (PCB) impairment of sediments resulting from historical PCB releases from AEDC into Woods Reservoir. A No Consumption-General Public fishing advisory has been issued for catfish (CH2MHILL 2005a, TDEC 2002b).

3.1.1.2 Wetlands

Wetlands are areas that are inundated with water or where water is present either at or near the soil surface for distinguishable periods throughout the year. Wetland flats and depressions are the two primary wetland types on Arnold AFB. The U.S. Fish and Wildlife Service (USFWS) completed a wetlands inventory and mapping project for Arnold AFB in 1998 and documented 1,894 acres of wetlands at 220 sites. Two hundred wetlands on the base totaling about 1,775 acres are classified as either flats or depressions.

Wetlands at Arnold AFB result from three major geomorphic features: karst pans, compound sinks, and intermittent headwater streams (Call 2003). Karst pans typically have depths less than 4.9 ft and level-bottom topography. Compound sinks generally have depths greater than 8.2 ft and complex bottom topography dominated by internal drainage systems consisting of coalesced sinkholes and connecting channels. Wetlands associated with headwater streams display a rapid surface water response to localized precipitation events. These areas remain wet for extended periods due to level topography and poorly drained soils. Hydrologic monitoring at the base has identified distinct water regimes associated with karst pans and compound sinks.

Two karst pans, Tupelo Swamp and Goose Pond, have water regimes characterized by narrow ranges of flooding depth, gradual seasonal rises and recessions, long hydroperiods, persistent soil saturation, and perched surface water systems. These similarities persist across significantly different hydrologic conditions. Most pans on the base support wet forests of willow oak, sweet gum, black tupelo, or red maple, but several support unusual natural communities that often include rare or disjunct plants and animals (Call 2003).

Three compound sinks, Sinking Pond, Westall Swamp, and Willow Oak Swamp, share the geomorphic characteristics of about 9.8 ft of internal relief and plainly visible sinkhole drains. Their water regimes are characterized by abrupt seasonal rises and recessions, typically 6.6 ft or more during periods as short as 1 to 3 days, and close interactions between surface water and groundwater. These interactions include water table control of sinkhole drainage and rapid groundwater response under the influence of concentrated recharge through the sinkholes. The annual flooding behavior of compound sinks is more sensitive to rain-fall during the fall and early winter than to total annual rainfall (Call 2003).

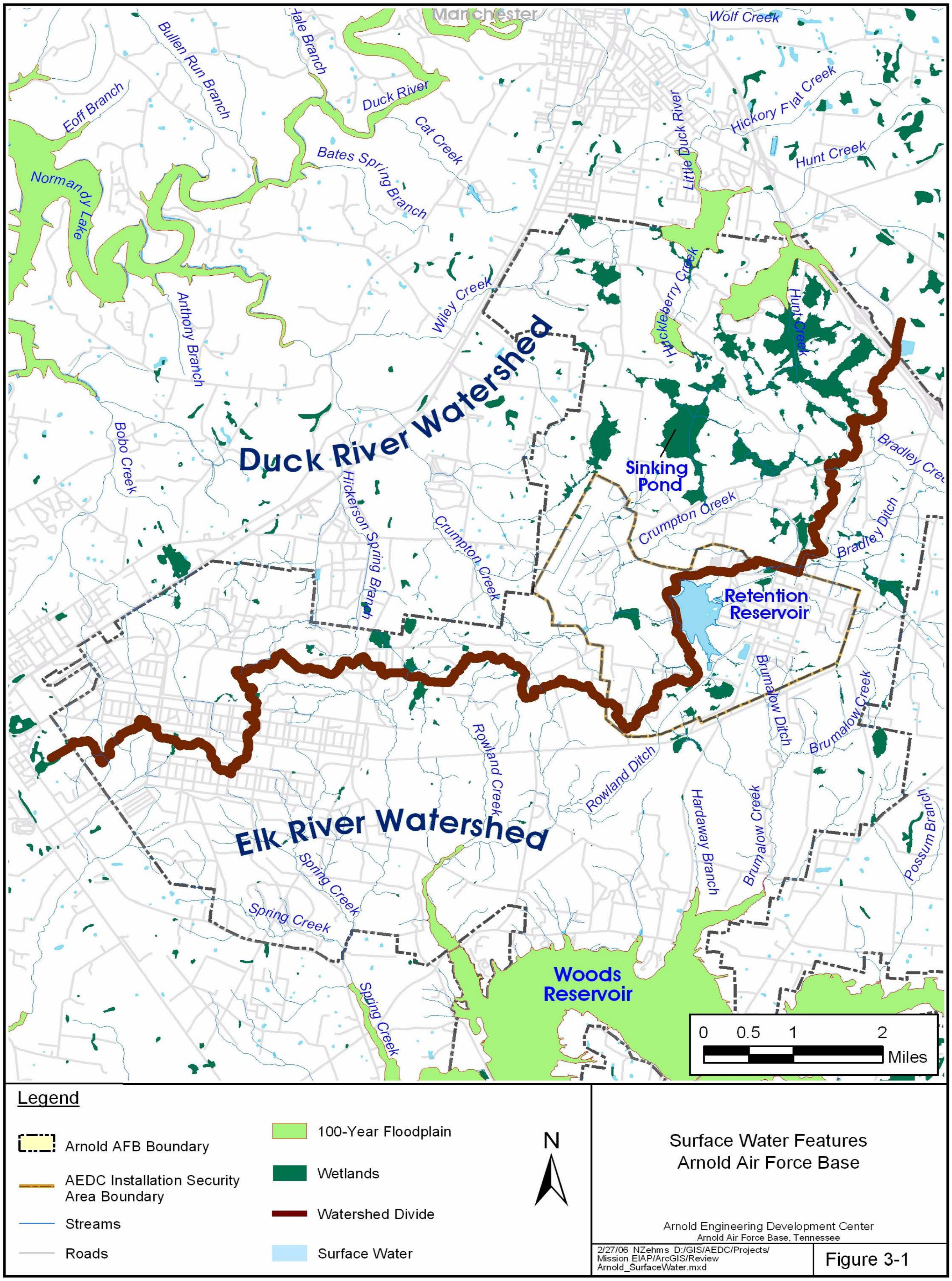


Figure 3-1. Surface Water Features

Goose Pond and Sinking Pond have been named as a National Natural Landmarks by the U.S. National Park Service. Goose Pond is remarkable for the diverse forest communities bordering it, and is also the site of a large number of rare plant species. Sinking Pond is well known locally for its abrupt seasonal flooding and drainage. One of the most pristine areas at Arnold AFB, Sinking Pond also is the site of one of the largest great blue heron rookeries in Tennessee.

Wetland fauna and flora are discussed in Sections 3.1.3.1 and 3.1.3.2.

3.1.1.3 Groundwater

Regional groundwater resources include the Mississippi Carbonate (karst), also known as the Highland Rim aquifer, which consists of flat-lying carbonate rocks of Mississippian age underlying Highland Rim physiographic province. The western portion of this province is dissected and hilly to steep, with the eastern, northern, and southern portions predominantly undulating. Bedrock formations have a deep chert regolith of up to 100 ft thick that stores groundwater and releases it to bedrock openings. There are fractures in the bedrock that permit rapid transmission of water. Well yields commonly range from 5 to 50 gpm (TDEC 2002a). Karst areas are characterized by sinkholes, springs, disappearing streams and caves, and rapid, highly directional groundwater flow in discrete channels. Since water can travel rapidly over long distances through conduits that lack natural filtering processes of soil and bacteria, karst systems are easily contaminated.

Groundwater beneath the base is present within the regolith and in the bedrock to a more limited extent. The main water-bearing unit in the area is within the chert rubble unit at the base of the regolith just above the bedrock, and the solution-openings in the upper portion of the bedrock (Aycock and Haugh 1999). A groundwater divide transecting Arnold AFB generally corresponds to the surface water drainage divide. Locally, vertical fractures in the bedrock may influence groundwater flow patterns. The lower portion of the Fort Payne bedrock has few fractures and low yields of water (Haugh and Mahoney 1994). The Chattanooga shale is considered to be the base of the fresh groundwater system in the area (Haugh and Mahoney 1994; Haugh 1996).

3.1.1.4 Water Quality Management

Water discharges from the AEDC complex are controlled through strict compliance with NPDES permits and other legal requirements. The NPDES permits set conditions for discharge of cooling water, sanitary wastewater, stormwater runoff, process and non-process wastewater, and other discharged water. Stormwater is controlled through compliance with NPDES permit requirements as well as other administrative and engineering controls. Spills that could potentially migrate to outfalls or enter the stormwater runoff are controlled through requirements of a Spill Prevention and Response Plan.

3.1.1.4.1 NPDES Permit

Water discharged from the AEDC industrialized area is managed in accordance with the requirements of NPDES Permit No. TN0003751 (Table 3-1, Figure 3-2, Appendix C). Two additional, multi-sector NPDES permits address the asbestos containing material and construction debris landfills (TNR053036) and the painting/blasting area (TNR053487).

The NPDES permits are administered by the Tennessee Department of Environment and Conservation (TDEC) Division of Water Pollution Control, in accordance with the provision of the Tennessee Water Quality Control Act, Tennessee Code Annotated, Sections 69-3-101 et seq., as implemented through the Rules of the Tennessee Department of Environment and Conservation, 1200-4-1 through 1200-3-11. The

NPDES permit provides legally enforceable conditions for waters discharged from the AEDC, including the elements listed below.

- Limitations to specific processes and locations (outfalls) for effluent discharge;
- Scheduled monitoring to ensure compliance with NPDES permit effluent criteria for specific contaminants and water quality parameters, such as trichloroethene, chlorine, solids, oil and grease, fecal coliform, pH, and dissolved oxygen;
- Prohibition of water discharge with any floating oil or other materials;
- Reporting of all NPDES compliance requirements;
- Disclosure of any discharges of certain toxic substances not otherwise included in the permit; and
- Development and implementation of a Stormwater Pollution Prevention (SWPP) Plan to manage and control stormwater runoff and a Spill Prevention Control and Countermeasures (SPCC) Plan.

AEDC NPDES Permit No. TN0003751, which has been administratively continued past the May of 2007 expiration date, authorizes discharges to specific outfalls in accordance with permit conditions. Activities outside of these parameters and any changes or new discharges require coordination with TDEC. AEDC ensures compliance through an environmental office that is responsible for all monitoring activities at outfalls and internal monitoring points (IMPs), recordkeeping, and reporting. Additionally, operators at water-discharging facilities are responsible for ensuring that activities are performed such that water quality at IMPs and outfalls is not impaired. Table 3-2 summarizes NPDES exceedences for CY 2000-2005, and Appendix E presents detailed results for the same period.

Auditing of compliance with the NPDES permit and other CWA requirements is performed through several mechanisms. The AEDC environmental office performs periodic internal audits of individual water discharges from specific facilities, IMPs, and outfalls. Additionally, individual water-discharging facilities perform self-audits. Results from these audits are used to develop corrective actions to mitigate potential future problems. The USAF also maintains the Environmental Compliance Assessment and Management Program (ECAMP) system for auditing all environmental compliance functions, including NPDES and stormwater permit compliance. The ECAMP system provides the USAF information on compliance for specific outfalls and bases, and is also used to determine USAF-wide compliance issues that may require programmatic corrective action.

Table 3-1. NPDES Facility Outfalls and Receiving Waters

AEDC NPDES Permit TN0003751	
Outfall	**Discharge Source**
001 Discharges to an un-named tributary to Rowland Creek	Sanitary Wastewater from STP
	ASTF air stripper
	AC&T air stripper
	Site 1 Groundwater Treatment Unit
	Site 22 Groundwater Treatment Unit
	Domestic potable water uses
	Photography lab
	Metal parts rinse tank effluent
	Oil/water separators

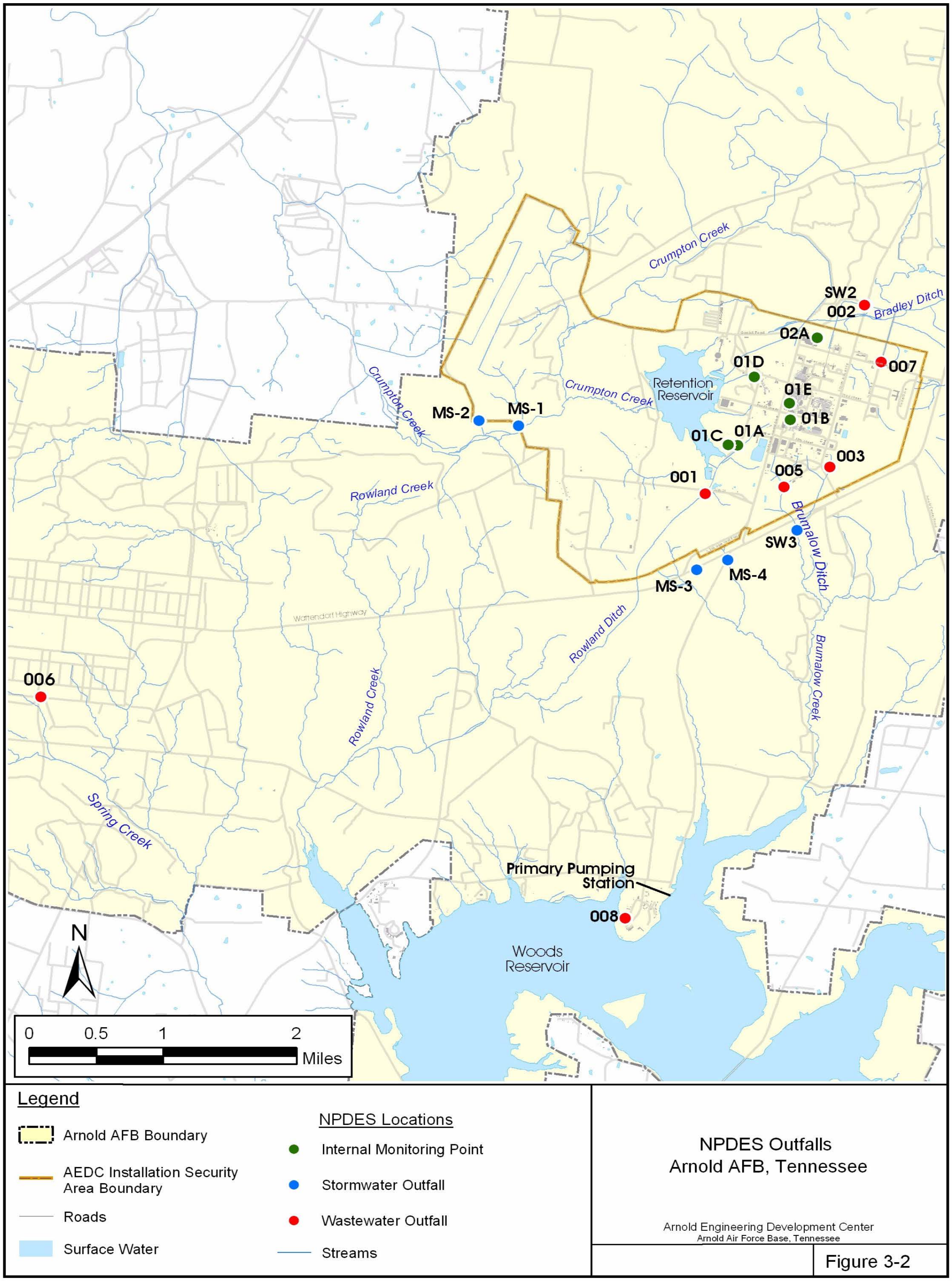
AEDC NPDES Permit TN0003751	
Outfall	**Discharge Source**
	Test cell cleaning
	Glycol Reboiler condensate
	VKF cooling water
	Water treatment plant backwash
	Turbine ETF cooling water
	Solid & Liquid Rocket ETF & APTU cooling water
	Misc. cleaning operations
	ASTF cooling water
	G-range cooling water
	Site 8 Groundwater treatment unit
	Cooling tower blowdown
	PWT cooling water
	Mark I cooling water
	PWT reverse osmosis discharge
	Stormwater runoff (320-acre total drainage area)
002/SW2[1] Discharges to an un-named tributary to Bradley Creek	VKF cooling water
	G-Range cooling water
	Glycol Reboiler condensate
	Oil/water separators
	Site 8 Groundwater Treatment Unit
	Stormwater runoff (200-acre total drainage area)
003/SW3[1] Discharges to an un-named tributary to Brumalow Creek	Cooling tower blowdown
	PWT cooling water
	Mark I cooling water
	Oil/water separators
	PWT reverse osmosis discharge
	Stormwater runoff (220-acre total drainage area)
004 Discharges to Woods Reservoir	Arnold Village Sewage Treatment Plant
005 Discharges to an un-named tributary to Brumalow Creek	
	Steam plant condensate
	Groundwater drainage
	Steam plant reverse osmosis
	Non-contact cooling water

AEDC NPDES Permit TN0003751	
Outfall	**Discharge Source**
006 Discharges to an un-named tributary to Spring Creek	Site 6 Groundwater Treatment Unit
007 Discharges to an un-named tributary to Bradley Creek	EAF Office Building HVAC discharge
	EAF Office Building groundwater drainage
	Non-industrial stormwater
008 Discharges to Woods Reservoir	Non-contact cooling water
	Non-industrial stormwater

[1] Outfalls 002 and 003 are permit compliance locations for process wastewater. SW2 and SW3 are typically monitored only during storm events when flow exceeds the capacity of the pumpback systems.

ACT – Air Compressor and Test
APTU – Aerodynamic and Propulsion Test Unit
ASTF - Aeropropulsion Systems Test Facility
EAF – Engineering Analysis Facility (otherwise known as the Carroll Building)
ETF – Engine Test Facility
HVAC – heating, ventilation, and air conditioning
PWT - Propulsion Wind Tunnel
STP – sewage treatment plant
VKF - Von Kármán Gas Dynamics Facility

Figure 3-2. NPDES Outfalls



NPDES Outfalls
Arnold AFB, Tennessee

Arnold Engineering Development Center
Arnold Air Force Base, Tennessee

Figure 3-2

3.1.1.4.2 Stormwater Management

Stormwater is managed and controlled in accordance with the NPDES stormwater permitting process under the CWA. AEDC complies with permit requirements through development, maintenance, and implementation of a Stormwater Pollution Prevention (SWPP) Plan that identifies pollutant sources and provides Best Management Practices (BMPs) to control stormwater runoff. This plan is reviewed annually and updated as necessary. BMPs for stormwater management controls are designed to prevent or mitigate pollution from any type of activity. BMPs consist of two general types:

- Generic BMPs that include preventive maintenance, good housekeeping, waste disposal practices, materials management practices, spill prevention and response measures, erosion prevention, employee training, recordkeeping, and reporting; and
- Activity-based BMPs that include those measures necessary to protect stormwater quality from specific industrial operations, such as practices associated with vehicle washracks, vehicle maintenance, vehicle and equipment paining, loading and unloading materials, ASTs, USTs, outdoor storage, and hazardous waste management.

Examples of BMPs include the use of stormwater management devices, limiting operation of heavy equipment on disturbed soils during wet weather, stabilizing and revegetating disturbed soils immediately upon completion of soil disturbance, properly storing and covering materials, training employees in proper operational and spill response procedures, periodically testing lines carrying potential contaminants, and designing new systems or system upgrades with fail-safe stormwater controls. The AEDC SWPP Plan provides a comprehensive description of generic and activity-based BMPs required at AEDC.

Compliance with BMPs is ensured through annual site-specific assessments as part of the facility stormwater system inspection. These assessments require updating of area-specific stormwater maps, including definition of stormwater drainage, potential sources of stormwater pollutants, and existing structural control measures, as well as identification of any additional BMPs. Stormwater management devices (engineering controls) include paving and grading to direct and control stormwater, storm drains, berms, diversion dikes, flow diversion structures, oil/water separators, siphon dams, sedimentation ponds, silt fencing, straw bales, secondary containment, and covers. These controls are used both to protect stormwater from becoming contaminated and to minimize the erosion of soils by stormwater flow. Regular inspections are performed to ensure proper maintenance and operations of these controls, and inspections of facilities and equipment are performed to ensure conditions protect stormwater protection.

The SWPP Plan establishes requirements for construction activities that could disturb areas between 1 and 5 acres (Phase II rules) and the requirements for areas greater than 5 acres (Phase I rules). Requirements include filing a notice of intent with TDEC prior to commencement of the work, preparation of a site-specific SWPP plan with BMPs for the activity, and filing of a notice of termination to TDEC upon project completion. The SWPP Plan also requires a Spill Prevention and Response Plan, as spills and leaks are two of the largest contributors to stormwater pollution. Spill prevention associated with management of fuels and hazardous waste is addressed in Section 3.2.4.3.

Auditing and corrective action requirements for stormwater management are comparable to those described in Section 3.1.1.4.1 for NPDES permits. Auditing of stormwater controls also includes review and examination of engineering controls to determine their effectiveness, particularly during a major storm event.

Table 3-2. Summary of NPDES Exceedences CY 2000-2005

Table 3-2: Summary of NPDES Exceedences CY 2000-2005

Outfall 001

Effluent Characteristic	Concetration		Exceedances of NPDES Criteria[1]											
			2000		2001		2002		2003		2004		2005	
	Daily Maximum (mg/L)	Monthly Average (mg/L)	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average
PH	6.5 to 9.0		3	0	3	1	3	1	1	2	1	2	1	0

Outfall 005

Effluent Characteristic	Concetration		Exceedances of NPDES Criteria											
	Daily Maximum (mg/L)	Monthly Average (mg/L)	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average
PH	6.5 to 9.0		0	2	0	0	0	0	0	0	0	0	0	0

Outfall 006

Effluent Characteristic	Concetration		Exceedances of NPDES Criteria											
	Daily Maximum (mg/L)	Monthly Average (mg/L)	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average
PH	6.5 to 9.0		0	0	0	2	0	6	0	0	0	0	0	0
Methylene Chloride	0.025	NA	6	NA	8	NA	0	NA	9	NA	0	NA	3	NA

Outfall 007

Effluent Characteristic	Concetration		Exceedances of NPDES Criteria											
	Daily Maximum (mg/L)	Monthly Average (mg/L)	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average
Flow		Report MGD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH	6.5 to 9.0		0	8	0	12	0	12	0	2	0	0	0	2

3.1.2 Air

Baseline conditions for air consist of the regional climate conditions and ambient air quality of the region. AEDC is located in an area with a temperate climate and low atmospheric pollutants.

3.1.2.1 Climate

The regional climate is classified as warm, humid, and continental. The climate is largely responsive to the movement of low- and high-pressure systems across Tennessee. The low-pressure areas are attended by warm, moist, tropical Gulf air and by rains over the entire state. In winter, the low-pressure areas are well developed and are frequently followed by high-pressure areas with polar Canadian air on their front, bringing clear, cold weather. In summer, the low-pressure areas are less active, but tropical maritime air moves inland and many thunderstorms develop. High-pressure areas produce morning surface inversions, which occur about 35 percent of the time during the winter and 40 percent of the time during the summer

Prevailing winds for Arnold AFB are from southerly directions during spring and summer and from northerly directions in the fall and winter. Winds are from the south 50 to 55 percent of the time and from the north 35 to 40 percent of the time. The prevailing annual wind direction is south-southeast with an average annual wind speed of about 8 miles per hour (Figure 3-3).

The average yearly temperature is about 60 degrees Fahrenheit (°F) (15.5 degrees Celsius (°C) with a frost-free growing season of approximately 190 days (ADEC 2005a). The annual average maximum and minimum daily temperatures are approximately 70°F (21°C) and 47°F (8°C), respectively. Historical extreme temperatures range from 106°F (41°C) to -14°F (-25°C). Rainfall averages approximately 57 inches (145 cm) per year and is heaviest in late winter and early spring. Precipitation is fairly evenly distributed throughout the year, with slightly less in fall and slightly more in winter. August is typically the driest month with an average of 3.4 inches (8.6 cm) of precipitation) and February has the highest average precipitation at 6.8 inches (17.2 cm) (www.noaa.gov). Table 3-3 summarizes the monthly average temperatures and precipitation.

Table 3-3. Monthly Average Weather Conditions[1]

Month	Average Maximum Temperature (°F/°C)	Average Minimum Temperature (°F/°C)	Average Total Precipitation (in/cm)	Average Total Snowfall (in/cm)
January	48.8/9.3	29.3/-1.5	5.51/14.0	2.0/5.0
February	52.6/11.4	31.6/-0.2	5.41/13.7	1.5/3.8
March	61.1/16.2	38.2/3.4	6.29/16.0	0.7/1.8
April	71.0/21.7	47.0/8.3	4.83/12.3	0.0/0.0
May	78.4/25.8	54.9/12.7	4.74/12.0	0.0/0.0
June	85.4/29.7	62.5/16.9	4.26/10.8	0.0/0.0
July	88.2/31.2	66.4/19.1	4.86/12.3	0.0/0.0
August	87.7/30.9	65.1/18.4	3.53/9.0	0.0/0.0
September	82.3/27.9	58.9/14.9	3.80/9.6	0.0/0.0
October	72.5/22.5	46.9/8.3	3.38/8.6	0.0/0.0
November	60.3/15.7	37.9/3.3	4.68/11.9	0.2/0.5
December	51.1/10.6	31.6/-0.2	5.65/14.3	0.9/2.3
ANNUAL	69.9/21.1	47.5/8.6	56.93/144.6	5.4/13.7

1 – Based on weather data for Tullahoma, Tennessee.
in – inches
cm - centimeters
°C – degrees Celsius
°F – degrees Fahrenheit

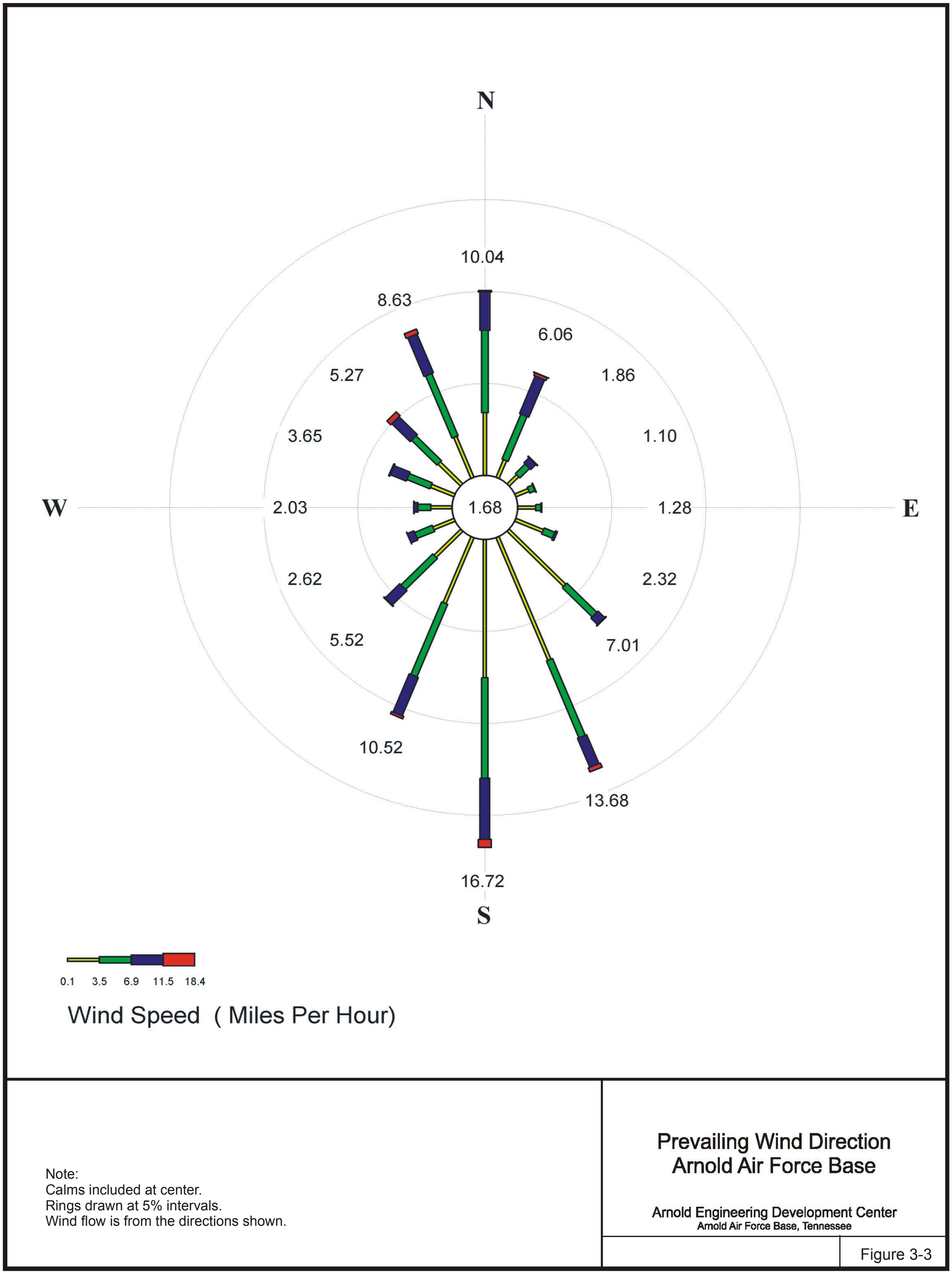


Figure 3-3. Prevailing Wind Direction

3.1.2.2 Air Quality

Air quality for a given area is defined by the concentration of various pollutants in the atmosphere, generally expressed in units of parts per billion (ppb) or micrograms per cubic meter (μg/m3). Air quality is determined by the type, amount, and concentration of pollutants emitted into the atmosphere, the size and topography of the basin, and the prevailing meteorological conditions.

Arnold AFB is located in the Tennessee River Valley - Cumberland Mountains Interstate Air Quality Control Region, which includes portions of Alabama and Tennessee. The regional air quality is good. Air pollutants are emitted from mobile and stationary sources including testing operations, aircraft operations, training operations, general maintenance activities, prescribed burning, wildfires, government and privately owned vehicles, and off-base commercial and industrial operations.

3.1.2.3 Air Quality Management

Arnold AFB is located in an attainment area for all pollutants, and AEDC is considered a major source of both criteria and hazardous air pollutants (HAPs). Air emissions from AEDC facilities are controlled through the AEDC Title V Major Source Air Quality Control Operating permit requirements (Permit No. 546264) under the CAAA program (Appendix E). This permit was issued by the Tennessee Air Pollution Control Board of TDEC in May 2002. There are currently 26 emission sources addressed by this permit, all of which are in compliance. Table 3-4 lists the permitted emissions sources, which are shown on Figure 3-4. Table 3-5 summarizes air emissions for CY 2000-2004 and Appendix G provides detailed results for the same period. Air emissions associated with each testing complex are presented in Section 4.

The AEDC Title V permit is administered by the TDEC Bureau of Environmental Health Services, Division of Air Pollution Control, in accordance with the provision of the Tennessee Air Quality Act, Tennessee Code Annotated, Sections 68-25-101 et seq., as implemented through the Rules of the TDEC, 1200-3-1 through 1200-3-36. The air permit provides legally enforceable conditions for the air emissions from the AEDC, including the elements listed below.

- Limitations to specific facilities and processes;
- Compliance with specific criteria, including non-process equipment standards, requirements to control asbestos during renovation or demolition activities, and other criteria established for emission of contaminants from permitted sources such as visible emission requirements and particulate matter, sulfur dioxide, nitrogen oxides, carbon monoxide, VOC, and hazardous air pollutants (HAP) standards;
- Compliance with operational limitations, such as maximum heat inputs to boilers, maximum total annual operating hours for a source, fuel type requirements, fuel content limitations, and fuel quantity limitations for engine testing;
- Prohibition of specific air quality impairment, such as requirements for reasonable precautions to prevent particulate matter from becoming airborne (fugitive dust) and prohibition of open burning except under specified circumstances;
- Monitoring of operations to ensure compliance with permit criteria for certain contaminants and air quality parameters, such as particulate matter;
- Limitations on construction of a new air contaminant source or the modification of an existing air contaminant source (requirement for an air quality construction permit);

Table 3-4. Title V Air Emission Sources

Title V Air Quality Operating Permit # 546264		
Emission Source No.	**Description**	**Facility Number**
# 01	Steam Plant A, Boiler #1 – provide steam for Base heat and electricity production	1411
# 02	Steam Plant A, Boiler #2 – provide steam for Base heat and electricity production	1411
# 03	Steam Plant A, Boiler #3 – provide steam for Base heat and electricity production	1411
# 04	Steam Plant A, Boiler #4 – provide steam for Base heat and electricity production	1411
# 05	Steam Plant B, Boiler #5 – used for plant operations	535
# 06	ETF Heaters – provide heated air for testing operations	898
# 07	VKF Heaters, Dryer Reactivation Heaters W15 (3 MMBtu/hr), W16 (6.8 MMBtu/hr), W17 (3 MMBtu/hr), W18 (4 MMBtu/hr), and Process Heater (175 MMBtu/hr) used for heating air for testing operations	676
# 08	Two PWT Air Dryers used for testing operations	784
# 14	APTU Test Facility, Vitiated Air Heaters, SUE Burner or Gas Generator for Testing Solid and Liquid Rocket Motors as well as Turbine Engines with wet scrubber control	579
# 17	Liquid Rocket Test Cells with wet scrubber controls. Testing may be conducted in 16-0010-17 Liquid Rocket Test Cell Facility, 16-0010-18 Solid Rocket Test Cell Facility, 16-0010-19 ETF Test Cells, or 16-0010-31 ASTF Test Cells (Facility Numbers 522, 530, 878, 880, 890, 912, or 2124)	530, 878, 890
# 18	Solid Rocket Test Cells - Solid Rocket Testing with wet scrubber control. This testing may be conducted either in 16-0010-18 Solid Rocket Test Cell Facility, 16-0010-19 ETF Test Cells, or 16-0010-31 ASTF Test Cells as well as enclosed chambers, such as the J6 dehumidification chamber, within the Solid Rocket Test Complex	878, 530, 522, 2124
# 19	ETF Test Cells (Including Glycol Reboilers A & B) with wet scrubber and vapor condenser control	880, 878
# 28	HB-1 Heaters (1A & 1B) - provide heated air for testing operations	662
# 30	ASTF Heaters, four (4) air heaters used for aeropropulsion testing	929
# 31	ASTF Test Cells And Glycol Reboilers (EG-A & EG-B) with wet scrubber control	912
# 35	VKF Auxiliary Heater	676
# 40	Chemical Cleaning Facility	448
# 42	ARC Heaters (3)	722
# 43	Steam Plant C	563
# 45	ASTF Air Strippers (2)	922
# 46	T-3 Air Heaters	878
# 52	PWT Engine Testing with wet scrubber control	745, 785
# 53	SL-1 Test Cell	1541
# 54	Westinghouse Combustor Test Rig	878
# 56	SL2/SL3 Test Cells (Large Engine Test Facility) PSD/BACT	538/539
# 67	AC&T Facility (Building #878). Air Stripper to remove VOC contaminants.	878

AC&T - Air Compressor and Test
APTU – Aerodynamic and Propulsion Test Unit
ARC – Aerospace Research Center
ASTF - Aeropropulsion Systems Test Facility
BACT – best available control technology
ETF – Engine Test Facility
MMBtu/hr – million British thermal units per hour
PSD – prevention of significant deterioration
PWT - Propulsion Wind Tunnel
VKF - Von Kármán Gas Dynamics Facility
VOC – volatile organic compound
2003/01/09

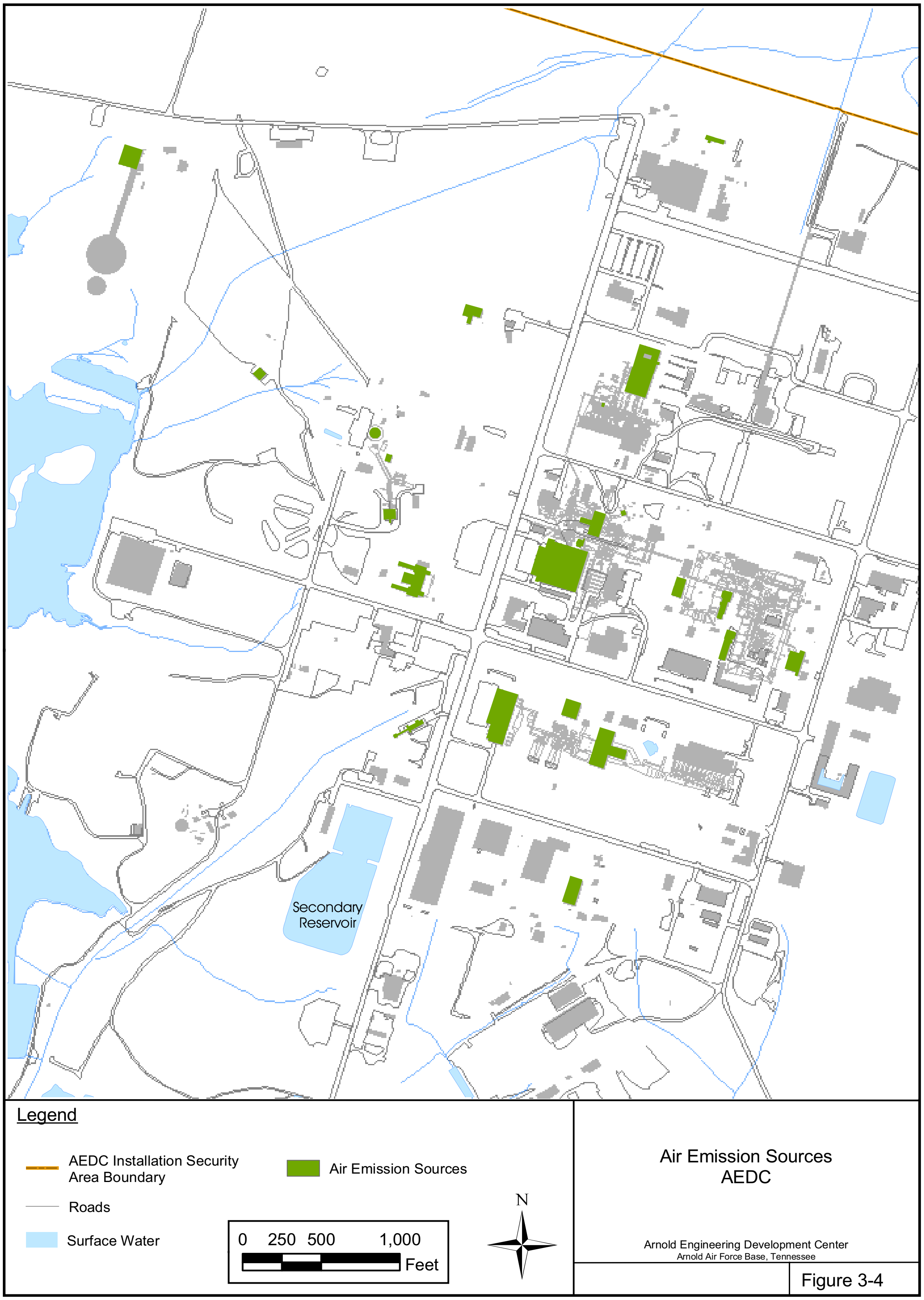


Figure 3-4. Air Emission Sources

Table 3-5. Title V Air Emissions Analysis Summary

Table 3-5: Title V Air Permit Analysis Summary

Source	Operating Hours		Fuel Usage		CO (tpy)		NOx (tpy)		PM (tpy)		SOx (tpy)		VOC (tpy)		Percent of Permitted Capacity (Maximum)	Limiting Parameter
	Limit	Max. Actual	Limit	Max. Actual	Limit	Max. Actual	Limit	Max. Actual	Limit	Max. Actual	Limit	Max. Actual	Limit	Max. Actual		
01	NA	NA	NA	NA	NA	6.0921	NA	7.2761	NA	0.5560	39	0.3312	NA	0.3987	0.85%	SOx
02 - 04	NA	NA	NA	NA	NA	20.4072	NA	25.2645	NA	2.0430	53.7	0.5411	NA	1.3274	1.01%	SOx
01 - 04 Total	26,000	19,275	NA	NA	NA	25.8697	NA	31.7674	NA	2.5373	NA	0.7182	NA	1.6851	74.13%	Op Time
06	NA	NA	NA	NA	NA	1.7677	NA	5.8922	NA	0.1599	NA	0.0126	NA	0.1157	NA	NA
07	Dryer Reactivation Heaters 1,920 hours/yr Process Heater 1,300 hours/yr	690 0	NA	NA	NA	10.8316	NA	14.4554	NA	0.9800	NA	0.0774	NA	0.7092	35.94%	Op Time
08	1,560	513.35	NA	NA	NA	1.2090	NA	1.4393	NA	0.1094	NA	0.1094	NA	0.0086	32.91%	Op Time
14	1,000	1.97	NA	6,834	NA	100.4063	NA	0.0543	NA	0.0004	NA	0.0001	NA	0.0025	0.20%	Op Time
17	NA	NA	Hydrazine: 327,000 lb/yr N_2O_4: 585,000 lb/yr	0	NA	0.0000	NA	0.0000	NA	0.0000	NA	0.0000	NA	0.0000	NA	NA
18	NA	NA	120,000 lb/Engine	75,243	168	7.2191	NA	0.0000	NA	0.0000	NA	0.0000	NA	0.0000	4.30%	CO
19	NA	1250	80,000 lb/hr	64,000 gal	83	5.6100	176	10.4800	NA	0.0640	NA	0.8400	7	0.4500	6.43%	VOC
19 & 31	3,600	1,633.81	NA	NA	NA	10.5338	NA	19.6885	5.8	0.1209	51.8	1.5751	NA	0.8468	45.38%	Op Time
28	3,000	619.40	NA	NA	NA	9.6368	NA	24.9197	NA	1.1467	NA	0.0645	NA	0.7111	20.65%	Op Time
30	NA	116	1.5 MGal/yr	272000	NA	3.7500	NA	15.0000	NA	2.4750	NA	32.4000	NA	0.1500	18.13%	Fuel Usage

Table 3-5: (continued)

Source	Operating Hours		Fuel Usage		CO (tpy)		NOx (tpy)		PM (tpy)		SOx (tpy)		VOC (tpy)		Percent of Permitted Capacity (Maximum)	Limiting Parameter
	Limit	Max. Actual	Limit	Max. Actual	Limit	Max. Actual	Limit	Max. Actual	Limit	Max. Actual	Limit	Max. Actual	Limit	Max. Actual		
31	NA	566	80,000 lb/hr jet fuel 90,000 lb/hr LH2	375300	NA	4.9300	NA	9.2100	NA	0.0570	NA	0.7400	NA	0.3960	NA[1]	Fuel Usage (hourly)
35	NA	NA	NA	NA	NA	5.8867	NA	19.622 4	NA	0.5326	NA	0.0420	NA	0.3854	NA[2]	NA
40	NA	NA	NA	NA	NA	0.0000	NA	0.0000	NA	0.0000	NA	0.0000	NA	0.4367	NA[2]	NA
42	27	1.12	NA	NA	NA	0.0000	20.4	0.4090	NA	0.0000	NA	0.0000	NA	0.0000	4.15%	Op Time
43	NA	NA	NA	NA	NA	0.5065	NA	0.6030	NA	0.0458	NA	0.0036	NA	0.0332	NA[2]	NA
45	5,000	3,664 [3]	NA	NA	NA	0.0000	NA	0.0000	NA	0.0000	NA	0.0000	NA	0.4256	73.28%	Op Time
46	416	229	NA	NA	NA	0.2321	NA	0.7735	NA	0.0210	NA	0.0017	NA	0.0152	55.05%	Op Time
52	250	0.00	Aircraft turbine engines 80,000Lbs/hr Small Liquid Rocket Motors 30,000 Lbs/yr Small Solid Rocket Motors 30,300 Lbs/yr	0	NA	0.0000	NA	0.0000	1	0.0000	1.4	0.0000	3.22	0.0000	0.00%	Op Time
53	480	0.00	1,220,000	0	17.9	0.0000	37.9	0.0000	0.9	0.0000	7.6	0.0000	1.6	0.0000	NA	NA
54	300	93.79	NA	NA	NA	3.8833	NA	12.944 8	NA	0.3518	7.2	0.0290	NA	0.2542	31.26%	Op Time
56	NA	1902	180,000 lb/hr	2,850,000 gal	1890	130.3010	1038	71.589 2	91	6.2755	114	7.8705	325	22.3783	6.90%	CO

Table 3-5: (continued)

Source	Operating Hours		Fuel Usage		CO (tpy)		NOx (tpy)		PM (tpy)		SOx (tpy)		VOC (tpy)		Percent of Permitted Capacity (Maximum)	Limiting Parameter
	Limit	Max. Actual	Limit	Max. Actual	Limit	Max. Actual	Limit	Max. Actual	Limit	Max. Actual	Limit	Max. Actual	Limit	Max. Actual		
67	1,200	220.12	Process water input rate shall not exceed 37,500 Lbs/hr			0.0000		0.0000		0.0000		0.0000	4.5	0.0045	0.10%	VOC

1 - Hourly fuel usage is managed as part of the test protocol to avoid exceeding the Title V permit limitation
2 - Permit conditions cannot be exceeded by the equipment operating within the equipment design capacity.
3 - Assume 109,905,000 gal/yr maximum and working at operating limits (30,000 gal/hr).

- Notification of other changes to an existing air contaminant source not otherwise requiring a construction permit, such as a change in equipment, change to the emission stack height or diameter, or change to emission gas exit velocity or temperature;
- Compliance with standards for recycling and emission reductions under 40 CFR 82, Subpart F for ozone depleting substances;
- Reporting of all permit compliance requirements and exceedance events, including semiannual reports and certifications and annual emission analyses;
- Recordkeeping of all permit requirements; and
- Disclosure of any discharges of certain toxic substances not otherwise included in the permit.

The AEDC Title V permit was scheduled to expire in May of 2007, but has been administratively continued by TDEC. The permit authorizes air emissions in accordance with the permit conditions; however, activities outside of these parameters and any modifications or new sources require coordination with TDEC.

AEDC ensures compliance with the air permit requirements through an environmental office that is responsible for recordkeeping and reporting. Additionally, operators of individual sources are responsible for ensuring that monitoring and compliance activities are maintained. The AEDC environmental office performs periodic internal audits of individual emission sources and staff at facilities with air emission sources also perform self-audits. The ECAMP system provides the USAF information on compliance for individual emission sources and bases and is also used to determine USAF-wide compliance issues that may require programmatic corrective action.

3.1.3 Biological Resources

Biological resources include the native and introduced terrestrial plants and animals on and around Arnold AFB. The area is home to a diverse range of biological resources including several sensitive species, habitats, and wetlands. The Air Force has identified a system of ecological associations based on floral, faunal, and geophysical characteristics that are identified in the *Integrated Natural Resources Management Plan* (ATA Conservation, December 2006). Data and information on biological resources at the base is available in numerous documents including the *Integrated Natural Resources Management Plan* (INRMP) and previous EAs, and is summarized in this section.

3.1.3.1 Fish and Wildlife

Wildlife species at Arnold AFB are those common to the central southeastern United States. AAFB has a diversity of habitats ranging from closed canopy forests to open grasslands, which provides for a highly diverse assemblage of fish and wildlife. To date, 412 species of vertebrates have been identified at the base including 226 species of birds (includes summer residents, migrants, and wintering species), 61 species of reptiles and amphibians, 42 species of mammals, and 83 species of fish.

A study conducted in 2000 to document bird use of wetland flats and depressions identified 59 breeding season birds using wetland areas, including 34 neotopical migrant species. Forty-six bird species were identified using the wetland flats and depressions in the winter (Roberts et al. 2001). Eighty-six bird species have been documented breeding at Arnold AFB (Lamb 1999, 2000, 2001, 2002, 2003, 2004a).

Management of fish and wildlife is discussed in Section 3.1.4.1.

3.1.3.2 Plant Species

Plant species found at Arnold AFB are those common to the Eastern Highland Rim Ecological Association. Oak-hickory forest, cedar glades, and a mosaic of bluestem prairie and oak-hickory forest dominate this association. The predominant vegetation type is temperate lowland and submontane broad-leaved cold-deciduous forest. Oaks (Quercus spp.) are the dominant canopy species. Hickories (Carya spp.), including pignut (C. glabra), mockernut (C. tomentosa), shagbark (C. ovata), and bitternut (C. cordiformis), form a common but minor component (CH2M HILL 2004a, McNab and Avers, 1994)

Vegetated portions of AEDC are composed primarily of landscaped plants and grasses with some areas of mixed hardwoods. An understory is generally absent due to browsing from deer. Numerous wetlands occur across the base, with prevailing vegetation ranging from grassland to closed-canopy forest. Figure 3-5 shows vegetation types on the base.

Arnold AFB lies in the heart of the Barrens region of the eastern Highland Rim. "Barrens" most often refers to grasslands similar to Midwestern tallgrass prairie but can also describe openings with scattered trees that resemble savanna or shrubland. Current vegetation on Arnold AFB is predominantly upland and swamp oak forest. Of the forested areas approximately 23,500 acres are native hardwoods and about 5,785 acres are planted, non-native pines. Forested areas are most frequently characterized by closed canopies dominated by various oaks.

A woodland/savanna mosaic was a dominant habitat prior to development of Arnold AFB. Woodland and savanna components include lightly forested, oak-dominated habitats with a grass- and forb-dominated understory. The reduction in wildfires in recent decades from modified land use and control measures has resulted in succession of most woodland and savanna habitats on the base to forested habitats with shrub-dominated understories. The original forest vegetation on base consisted of an oak-hickory forest type on the better-drained soils and a mixed bottomland hardwood type on poorly drained soils. High-grade logging practices and burning to create woodland pasture led to development of forest consisting primarily of blackjack oak, post oak, and scarlet oak on the thinner and drier upland soils with stands of southern red oak, white oak, water oak, and willow oak found on the wetter areas. Pine is not native to this part of Tennessee but was planted on approximately 5,700 acres of the base between 1950 and 1972. A pine reforestation program was initiated in 1983 to re-establish loblolly pine on pine sites that were removed. Recent infestations of southern pine beetle have resulted in re-evaluation of pine management strategies on Arnold AFB. In 2003, a decision was made to convert some pine acreage to open Barrens habitat by not replanting after salvage harvest of the dead trees along Wattendorf Highway (Call 2003).

The flora of the region has long been noted for its unusual Coastal Plain disjuncts, which are species that normally occur only in the Atlantic or Gulf coastal plains. These species are found nowhere else in Tennessee. Over 900 vascular plant species have been recorded on the base (Call 2003). The Nature Conservancy and the Tennessee Division of Natural Heritage classified and mapped the vegetation of Arnold AFB. Seventeen of the 33 vegetation associations found on Arnold AFB are considered "imperiled" community types.

The *Invasive Pest Plant Management Plan* identified 14 priority-invasive pest plant (IPP) species based on the potential threat to ecological and agricultural systems at Arnold AFB. Most of the priority-IPPs at the Base are included in the Tennessee Exotic Pest Plant Council's (TN-EPPC) list of 'Severe' and 'Significant' threat category IPPs (TN-EPPC, 2002). The main pathways of dispersal for these species range from bird and small mammal dispersal to water dispersal. They may also be transported by off-road vehicle travel.

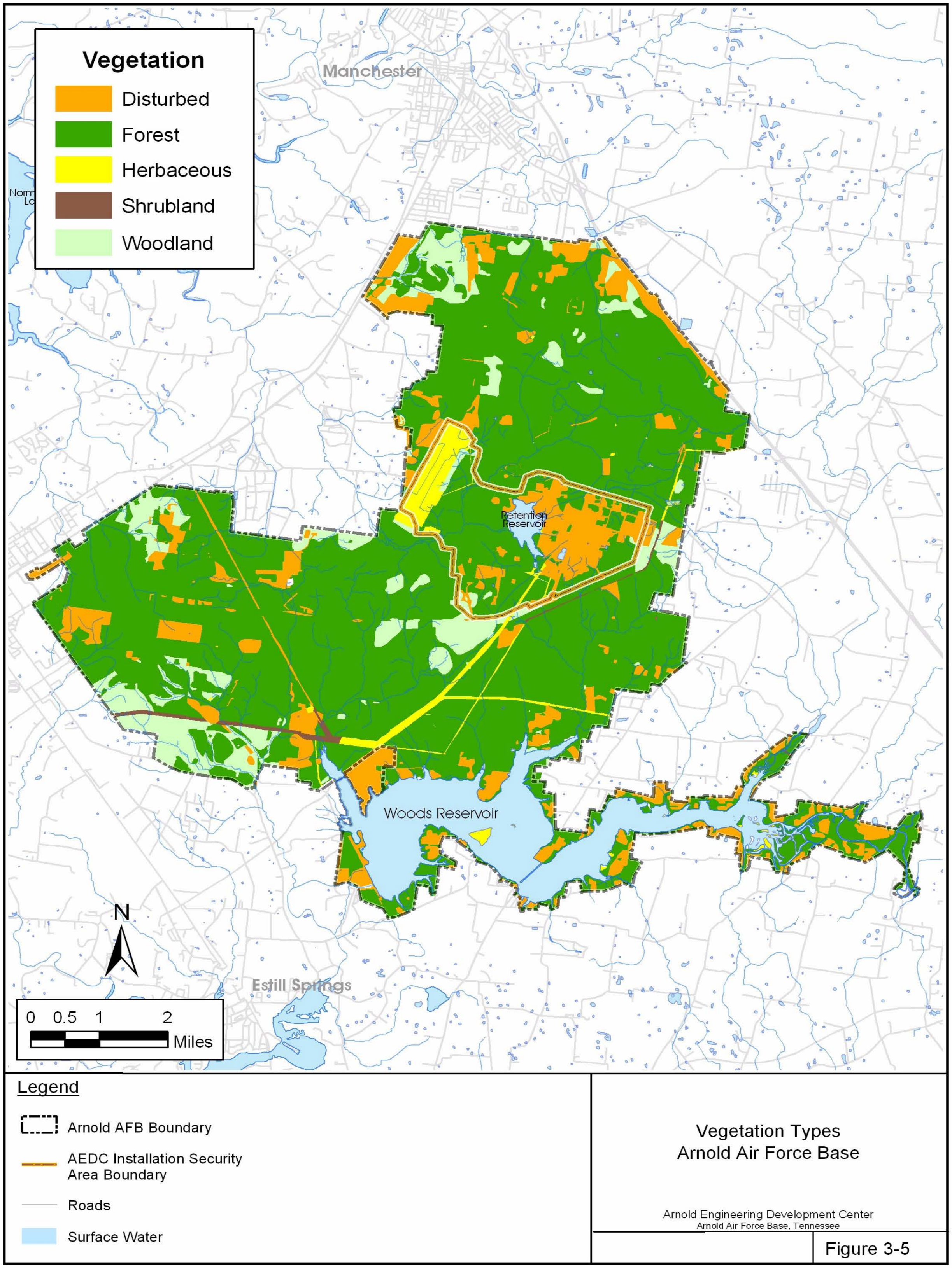


Figure 3-5. Vegetation Types

3.1.3.3 Threatened, Endangered, Special Concern Species and Rare Communities

Two federally listed species are currently known to occur on AAFB; the gray bat (Endangered) and bald eagle (Threatened). Eggert's sunflower, formerly listed as Threatened, was removed from the list on 19 September 2005. In addition, 19 animals and 63 plants are state listed as threatened, endangered or special concern species (Appendix H). Observations of threatened and endangered species on Arnold AFB are shown in Figure 3-6.

A gray bat colony residing on the base AFB at Woods Reservoir Dam is listed as a Priority 2 maternity colony in the USFWS *Gray Bat Recovery Plan* (USFWS 1982). This is one of very few maternity colonies that have been identified as using manmade structures for a maternity roost (Lamb, 2003b). In addition to the gray bat, five ecological systems and two species assemblages of concern on AAFB were identified during the Site Conservation Planning Process. These conservation targets include amphibians, karst wetlands, streams, springs, and associated riparian habitats, closed canopy hardwood forest, woodland/savanna/shrubland, grassland and, RTE flora.

Gray bats forage primarily on aquatic insects along forested riparian corridors and use other forested corridors as travel routes. The canopy provides protective cover from potential predators (Rommé and Reaves, 1999; Lamb 2003b). Mist net surveys at Arnold AFB have captured gray bats foraging along Elk River Bottoms, Bradley Creek, Brumalow Creek, and Rowland Creek. Juvenile bats typically forage in wooded areas around the maternity cave (Rommé and Reaves, 1999; Lamb, 2003b). Protection of these areas is important to recovery and maintenance of the species.

Of the estimated 50,000 bald eagles in the United States, 80 percent are found in Alaska (Murphy et al. 1989). Tennessee's bald eagle population is the highest in winter when birds migrate from the north. Bald eagles winter primarily in western parts of the state, particularly at Reelfoot Lake and at Dale Hollow Reservoir. However, bald eagles may occur on almost any waterway in the state (TWRA 2004). In the southeast, bald eagles build their nests in early September. While no bald eagles have been documented nesting at Arnold AFB to date, there have been one to two observations of the species every year at Woods Reservoir since 1989, with a total of 28 observations of adults and two observations of immature eagles (Lamb, unpublished data).

Twenty-six target species are associated with wetland flats and depressions. The gopher frog (Rana capito) is present wetlands on the base, but its subspecific status yet to be determined. The presence of this species at the base is disjunct, separated from the nearest populations by several hundred miles and may represent a distinct subspecies. Many of the rare plants associated with the wetland flats and depressions classification also are disjunct populations of species whose central ranges are limited to the Atlantic or Gulf Coastal Plains. Several of the disjunct species associated with wetland flats and depressions are documented in Tennessee only from Arnold AFB.

Air Force projects that could affect federally protected species and species proposed for federal listing are subject to the Endangered Species Act (ESA), which requires designation of critical habitat for federally listed species. However, no areas on Arnold AFB are designated as critical habitat under the ESA.

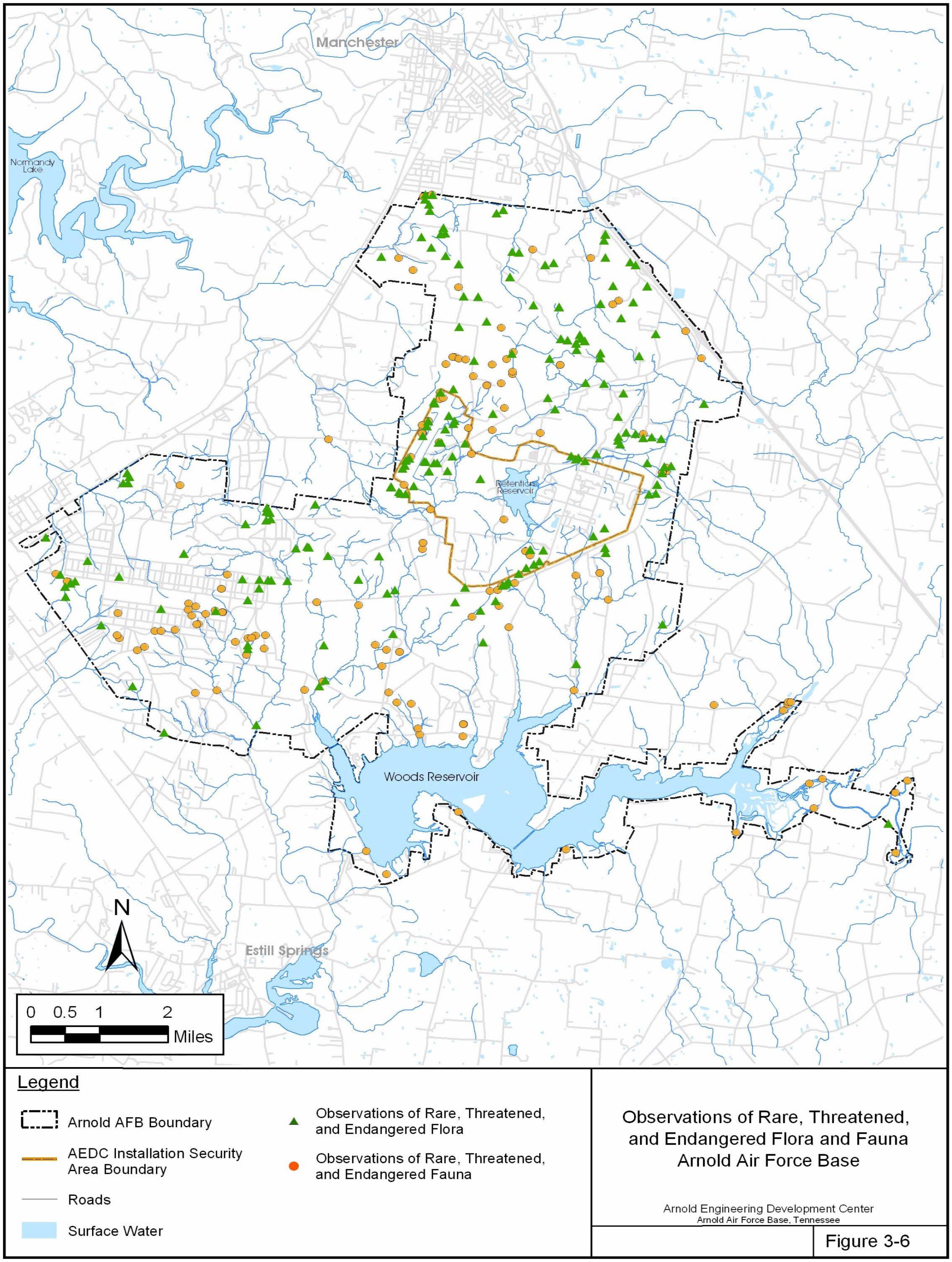


Figure 3-6. Observations of Rare, Threatened and Endangered Flora and Fauna

3.1.3.4 Biological Resource Management

Biological resources at Arnold AFB are managed through the Conservation Program, which has been established to protect resources and support the base's military mission by maintaining compliance with applicable laws, regulations, Executive Orders, and DoD and Air Force Instructions. The broad goals for conservation and ecosystem management for Arnold AFB include those listed below.

- Develop an integrated natural/cultural resources management program that enhances AEDC's ability to achieve its mission;
- Maintain, enhance, and restore the ecological integrity of lands through an integrated natural resources management approach utilizing adaptive management principles, linking management and monitoring within a research framework;
- Protect, restore, and maintain viable populations of native species found on AEDC, including rare, threatened, and endangered (RTE) flora and fauna species, in accordance with state and federal laws;
- Protect, restore, and maintain wetlands in accordance with state and federal laws;
- Manage game and non-game species;
- Ensure that human land uses are consistent with protection and maintenance of ecological integrity; and
- Ensure that the outcomes of management actions are socially and economically acceptable.

Strategic management guidelines are defined in the *INRMP*, which establishes the foundation from which operational plans are developed to implement the strategy for management of natural and cultural resources, ensuring that specific management actions adhere to the sound ecosystem management principles. Multiple management plans are contained within the Integrated Ecosystem Management Plan, including the *Two-Year Conservation Management Plan*, the *Two-Year Forest Management Plan*, *Two-Year Fish and Wildlife Management Plan*, the *Barrens Management Plan*, the *Invasive Pest Plant Management Plan*, the *Eggert's Sunflower Management Plan*, and the *Gray Bat Management Plan*. The principles and strategies of the *Integrated Ecosystem Management Plan* include those listed below.

- Maintain and improve the sustainability and native biological diversity of dynamic ecosystems;
- Administer actions with consideration of ecological units and time frames;
- Support sustainable human activities;
- Develop a vision of ecosystem health;
- Develop priorities and reconcile conflicts;
- Develop coordinated approaches to work toward ecosystem health;
- Rely on the best science available;
- Utilize benchmarks to monitor and evaluate outcomes;
- Apply adaptive management; and
- Implement programs and actions through installation-wide plans and programs.

Ecosystem management addresses systems holistically and recognizes the complex interrelationships between components. By considering these relationships, it endeavors to achieve the health and sustainability of the overall system rather than focusing on individual aspects. The initial step in implementing ecosystem management involves collecting baseline information to develop broad management goals and specific objectives. Programs and discrete projects are then developed from the broad management goals. Monitoring programs with specifically defined objectives are used to quantitatively assess the effects of management actions.

The Conservation Program operates in accordance with the *Two-Year Conservation Management Plan* to coordinate the planning, implementation, and monitoring of land management activities at Arnold AFB for habitat restoration, forest management, cultural resource management, and fish and wildlife management. The Conservation Program restores and maintains habitats for rare species and communities through the use of prescribed burning, mechanical thinning, and mowing. These efforts specifically target the maintenance of ecosystem integrity by conserving native plant and animals, increasing suitable habitat for rare species, and preventing the spread of non-native species. Monitoring and inventorying of species and communities of concern under a centralized program allows evaluation of program effects and assessment of impacts to biodiversity from multiple land uses. Monitoring efforts include the Barrens Mosaic, karst wetlands, streams and springs, and the Gray Bat.

Research is a component of ecosystem management. Recent and ongoing research efforts include issues related to the Eggert's sunflower, the Northern Pine Snake, tree species at Sinking Pond; vegetation, climate, and soil effects on recharge and soil water balance in the Barrens Mosaic.

3.1.3.4.1 Fish and Wildlife Management

Arnold Air Force Base (AAFB) is a Category I installation having suitable habitat for conserving and managing fish and wildlife. The Tennessee Wildlife Resources Agency (TWRA) has a Memorandum of Agreement (MOA) with AAFB which allows TWRA to conduct wildlife management operations under the direction of the AAFB Natural Resources Manager (NRM) on some 32,000 acres as a State of Tennessee Wildlife Management Area. The portion of AAFB that is outside of the security area is referred to by the TWRA as the "AEDC Wildlife Management Area." The area is open to the public for hunting and fishing, and state permits and licenses are required. Permits for the quota deer hunts are obtained by application to the Nashville TWRA office and are allocated based on the quota hunt drawings. All other licenses and permits are available at any of the approximately 1,000 TWRA license agents in the state.

In the 1950's, a comprehensive game management plan was initiated to increase wildlife populations so that reasonable harvests by the public would be possible. From 1954 to 1964, over 17,000 quail, 6,000 pheasant, 64 deer, and 21 turkeys were stocked. In 1974, the stocking of Giant Canada Geese began, with 53 geese stocked on the Retention Pond. An additional 50 geese were stocked in 1975. There are now abundant populations of deer, quail, geese, and turkeys on AAFB. Populations of deer and geese have reached nuisance populations over the years.

While no recent data is available for deer population densities on the base as a whole, a pilot study in 2005 using camera census techniques within the 3,683 acre AEDC industrial complex estimated densities to be a minimum of 57 deer per square mile. High deer densities in the industrial area have been associated low body weights compared to adjoining areas in Tennessee, and are well above the accepted threshold of 20-25 per square mile (8 per square kilometer) which has been shown to negatively impact hardwood forest regeneration, create a decline in abundance and diversity of herbaceous vegetation and the abundance and diversity of intermediate canopy nesting birds (Tilghman 1989).

The population of resident giant Canada geese at AAFB reached nuisance levels by the mid-1990's. In response to this growing problem, AAFB entered into a cooperative agreement with the United States Department of Agriculture Wildlife Services (USDA WS) in 2003 to manage resident populations. Efforts to reduce and control the resident goose population include capture and relocation during the molting period and hazing at recreation areas (USDA WS 2005).

There are currently nine deer hunts each year. Small game hunting, except for coyote and bobcat, is closed during each of the deer hunts. Popular small game species include squirrel, raccoon, rabbits, quail, dove, and various duck species. Turkey hunts consist of 4 three-day hunts (for bearded turkeys only) held during the month of April. Waterfowl seasons are subject to the final U.S. Fish and Wildlife Service waterfowl regulations. The TWRA is responsible for administrative, maintenance, and data collection activities related to the fish and wildlife program at AAFB. Wildlife and fish data collected on base provides scientific information for decisions regarding fish and wildlife harvest. For most wildlife species, the number of hunts, length of the hunt, hunter quotas, and bag limits are used to control the number of animals harvested.

Large mouth bass are the most sought after sport fish on Woods Reservoir followed by smallmouth bass. Crappie are also a sought after game fish with white crappie dominating the crappie creel at 79% and black crappie at 11% (Riddle 2005).

3.1.3.4.2 Management of Threatened and Endangered Species and Habitats

Management to sustain the biodiversity of RTE species requires compliance with all applicable laws and regulations such as the ESA and Air Force Instruction (AFI) 32-7064. Chapter 7 of AFI 32-7064, *Threatened and Endangered Species Management*, requires compliance with the ESA and the concurrent protection and conservation of federally listed threatened and endangered (T/E) plants and animals and their habitats. Section 7.1 states that conservation includes the use of all methods and procedures which are necessary to bring any T/E species to the point where the measures pursuant to the ESA are no longer necessary. Additionally, Section 7.1.2 outlines the protection and conservation of state listed protected species and for Integrated Natural Resource Management Plans (INRMPs) to provide for the protection and conservation of state listed protected species when practicable.

Adaptive management requires effective monitoring that permits managers to track various ecosystem conditions relevant to programmatic goals. The inherent complexity of ecological systems requires conservation practitioners to act with incomplete information. Effective monitoring programs should integrate information collected at multiple scales, including species and their populations, communities and the ecological systems they comprise, and the landscapes within which ecological systems function.

The Arnold AFB INRMP currently under development addresses management of certain species and habitats. The colony of gray bats inhabiting the dam is protected under the requirements of the ESA. The policy of Arnold AFB is to comply completely with the provisions of this Act, while at the same time protecting the operational capability of Woods Reservoir Dam and ensuring freedom of action in case of an emergency that might endanger lives. Gray Bat management includes performing maintenance at times that will minimize disturbance, restricting use of surface lights adjacent to the roosting area, and posting and prohibiting access to the area. No management actions are currently planned for Bald Eagle management, as this species is not known to roost in the area.

Eggert's sunflower management is integrated with other aspects of AAFB ecosystem management program by restoring and maintaining vegetation structure and ecological processes in suitable habitats. Such process-oriented management supports mission flexibility by working at multiple spatial and temporal scales to conserve biological diversity associated with two of the base's barrens associated focal conservation targets: woodland/savanna/shrubland and grassland. The management strategies implemented for Eggert's Sunflower are mowing and prescribed burning, forest canopy/understory thinning, and invasive pest plant management. Burning and mowing provide for mission support by maintaining open training habitats and rights-of-way. Preventing encroachment of woody species into the railroad right-of-way minimizes maintenance costs by reducing potential obstructions that would impede rail traffic. Efforts to control IPPs in selected locations containing Eggert's sunflower were initiated in 1998 and 1999.

Monitoring data suggest no need for active management of Least Trillium or Kentucky Lady's-slipper at this time to stabilize or increase this population. Future actions may include IPP management.

Pine snakes are typically found in areas that have been recently burned, where openings are maintained, in open pine stands, or relatively open deciduous forests. The snakes avoid both closed-canopy pine and closed canopy hardwood forest (Bailey et al. 2003). Proposed conservation strategies consist of maintaining a mosaic of open, frequently burned (every 2 to 3 years) management units for their value as habitat for Northern pine snakes, potentially including timber thinning and leaving stumps as habitats, retaining old structures, restricting vehicle traffic, and managing the time and frequency of mowing.

Henslow's sparrow is a nested conservation target for the grassland focal target. This species requires open habitat greater than 30 ha with a relatively high cover of tall, standing grassy vegetation, a well developed litter layer, and low woody stem densities (Zimmerman 1988). Proposed conservation strategies include maintaining large grasslands as management units for breading habitats, prescribed burning, and managing the time and frequency of mowing.

Amphibian management will include managing terrestrial areas peripheral to wetlands, particularly those within the closed canopy forest for ecological integrity and connectivity to wetlands. Conservation strategies will also consider the importance of maintaining the connectivity of suitable terrestrial habitats between isolated wetlands for corridors of movement of amphibians, reptiles, and other wetland-dependent wildlife species (Bailey et al. 2000). Connectivity helps to ensure successful recolonization of seasonally flooded temporal aquatic habitats from more permanent source wetlands, and counterbalance inevitable extinction of small local populations with the colonization of new sites (Semlitsch 1998).

Management of closed canopy hardwood for the period covered by the pending INRMP will be to discontinue maintenance of select food plots and "day lighting" of roads that are fragmenting the closed canopy hardwood forests and allow them to revegetate naturally, and the need for more active management will be evaluated.

Management of woodland/savanna/shrubland and grassland will consist of returning the ecological process of fire. However, fire alone may not be sufficient in some areas, so canopy thinning and reduction using commercial timber harvests will be used when deemed necessary. Periodic mowing may also be used for grasslands.

Management actions for karst wetlands will be planned during the effective period of the pending INRMP (2007 - 2011).

3.2 Human Environment

3.2.1 Cultural Resources

Cultural resources consist of the historical human environment. Cultural resources at Arnold AFB include prehistoric resources, historical resources, and Native American resources. Beginning in 1977, various studies and surveys have been conducted to identify potential archaeological sites at the base, and newly discovered sites are surveyed and documented on an ongoing basis. All areas within Arnold AFB and AEDC have been categorized as Cultural Resource Management Sites, high probability, low probability, or surveyed and cleared (Figure 3-7) Uncleared locations where new construction or other activities are planned that could impact previously unidentified archaeological resources are surveyed prior to disturbance.

Cultural resources are protected under various laws, including the National Historic Preservation Act of 1966 (NHPA) (16 USC 470 et seq., as amended), which requires identification of effects on cultural resources and requirements to ensure these resources

and requirements to ensure these resources are appropriately evaluated and protected; the Archaeological Resources Protection Act (16 USC 470a-11, as amended), which protects archeological resources on federal lands; the American Indian Religious Freedom Act (42 USC 1996 et seq, as amended); and the Native American Graves Protection and Repatriation Act (25 USC 3001 et seq, as amended). Management and protection of cultural resources at AEDC is administered through the AEDC Conservation Program in accordance with the *Integrated Cultural Resource Management Plan* (ICRMP). This plan provides a history of past use of base lands, identifies significant cultural resources identified on the base, and establishes guidelines to protect these resources in the future.

The NHPA requires that all federal agencies evaluate potential adverse impacts to historic properties under their control. Buildings may be determined eligible for listing on the National Register of Historic Places (NRHP) because of their architecture or historical events that occurred there. All buildings 50 years or older must be evaluated prior to modification or demolition, and building younger than 50 years also must be assessed for Cold War significance. AAFB is presently in the process of identifying historic buildings on base.

Presently, Arnold AFB has no structures or landmarks listed on the National Register of Historic Places.

3.2.1.1 Prehistoric and Historic Resources

Surveys conducted at the base have identified 107 prehistoric and historic sites dating back to Early Archaic times (CH2M HILL 2003 and 2004a, Hajic et al. 2002). These include 40 prehistoric sites, 55 historic sites, and 12 mixed prehistoric and historic sites. Of these 107 sites, 6 have been deemed eligible for listing on the NRHP and 40 are considered potentially eligible (CH2M HILL 2003 and 2004a).

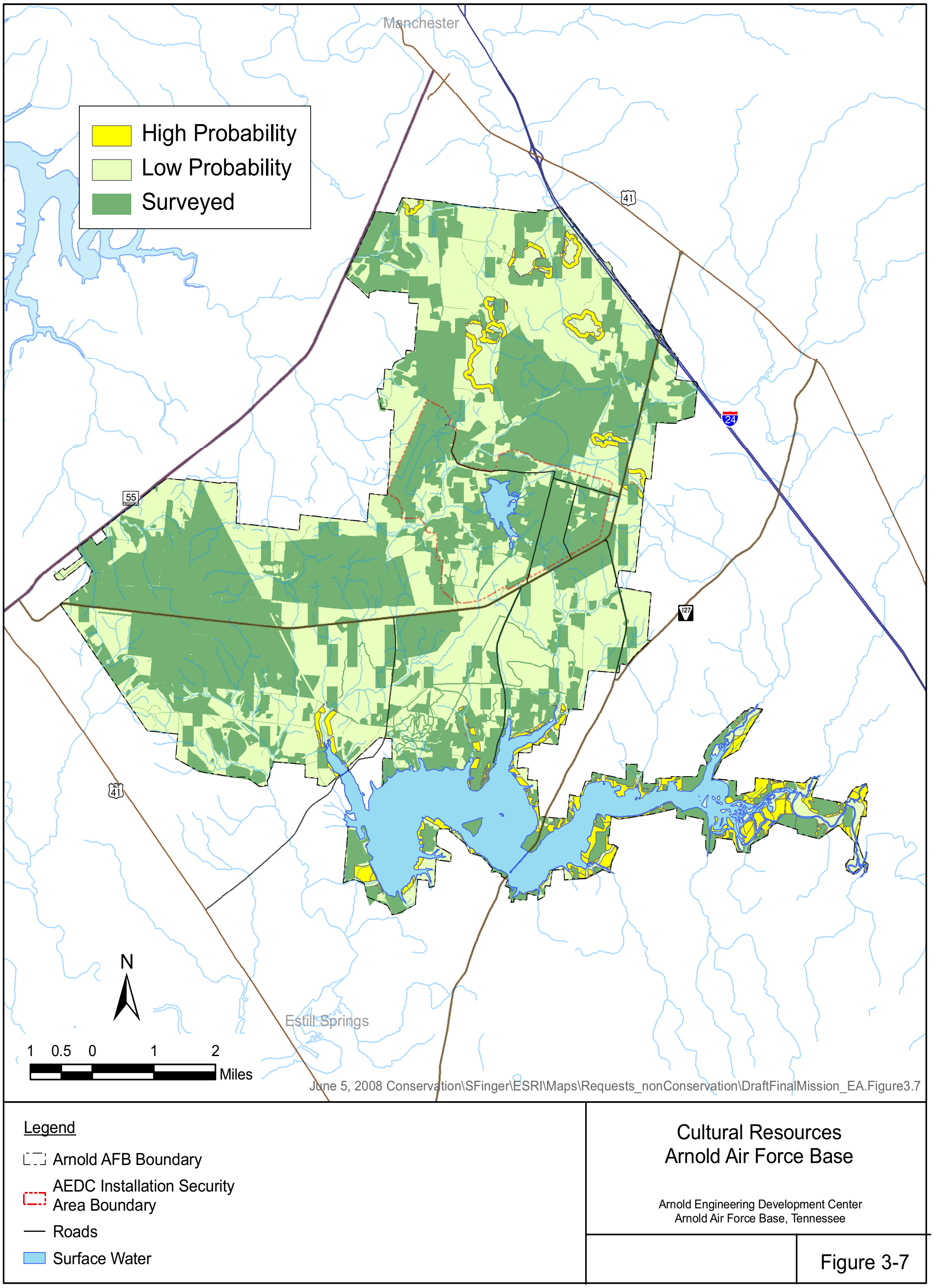


Figure 3-7. Cultural Resources

Prehistoric sites at Arnold AFB include open habitations, isolated prehistoric Native American lithics, extensive scatters of lithic debris containing artifacts dating from the Paleo-Indian through the Late Woodland periods, and a midden mound. Historic sites include the scatters of early to mid-19th century ceramics and glass, the remains of late 19th/early 20th century farmsteads, houses, outbuildings, wells, cemeteries, elements of the Camp Forrest built environment, and facilities associated with the AEDC industrialized complex (AAI 2000; Call 2003).

Pre-dating Arnold AFB, Camp Peay occupied a 1,040-acre tract in the southwest portion of the present current base boundary. Camp Peay was established in 1926 as a Tennessee National Guard training camp. Camp Forrest was founded in 1941. Encompassing 85,000 acres, it was one of the nation's largest training centers before World War II. Approximately 22,000 prisoners of war were housed there during the war, representing a number of nationalities including resident aliens, Germans, and Italians. After the war ended, Camp Forrest was declared surplus property and the buildings and support systems were dismantled and sold. There are four surviving structures associated with Camp Forrest: two small concrete utility buildings of unknown use, a former brick jail, and a cold storage building. These resources were recommended as ineligible for the NRHP due to loss of integrity and loss of context caused by the removal of Camp Forrest (TRC Garrow Associates et al., 2001).

There are five family cemeteries on the base. These are small family plots that do not contain graves of extreme age, nor are they associated with persons or events of great significance. They do not evidence distinctive design features and are considered ineligible for the NRHP (TRC Garrow Associates et al. 2001).

The establishment of AEDC was authorized by a Congressional Act (PL 81-415), and the facility was designed and constructed as a state of the art, completely self sufficient complex focused on transonic and supersonic aeronautics development and testing, and the installation continued that same mission today.

3.2.1.2 Native American Resources

Southern middle Tennessee was occupied by the Overhill Cherokee until early 1700s. In 1716, Colonel George Chicken was appointed superintendent of the Native American Trade by South Carolina and in 1725 he visited the Overhill. This was the beginning of a series of British visits to secure Cherokee assistance against the French (Chapman 1985:103). The Cherokee-British alliance was tenuous and eventually relations became strained because of a series of conflicts. The French and Indian War ended in 1763 with the British in control of most of eastern North America. Most of the Cherokee population fled to the Overhill area.

Prehistoric chronology of the southeastern United States has been divided into four major periods: Paleoindian, Archaic, Woodland, and Mississippian. The main criteria for the division of these periods are typological differences in projectile point forms and the introduction of agriculture. The distribution of the Native American record across the Arnold AFB landscape is strongly patterned. Extensive scatters of lithic materials dating to all of the known cultural-historic periods except the Paleo-Indian are documented for the area across the terrace landscape surrounding Woods Reservoir. Across the upland landscape, the surface distribution of artifacts is much more scattered and less extensive (AAI 2000). Arnold AFB may contain resources that are sensitive to Native American groups, such as prehistoric and historic villages, ceremonial areas, cemeteries, and burials (USAF 1996). Higher probably areas for these resources areas are confined to the major streams of the Elk and Duck River drainages, with upland areas representing low probability areas (Figure 3-7).

Arnold AFB works closely with federally recognized American Indian tribes in government to government consultation in accordance with Presidential Executive Order 13175 and the Presidential Memorandum on

Government to Government Relations with Native American Tribal Governments dated 29 April 1994; the DoD Policy on American Indian and Alaska Native Policy (20 October 1998); and AFI 32-7065, Section 3.2, Consultation with Native Americans (1 June 2004). Arnold AFB has contacted all Native American Tribes that might have connection to the land and Memoranda of Understanding (MOU) have been signed with a number of tribal governments which provide guidelines for addressing means of consultation, compliance with Section 106 of the NHPA, consultation pertaining to human remains and other NAGPRA items, and additional considerations. Issues addressed in the MOUs are expounded upon in the ICRMP.

3.2.2 Occupational Health and Safety

Arnold AFB Safety, Health and Environmental (SHE) Standards are based on and consistent with Occupational Safety and Health Administration (OSHA) law (42 USC 651 et seq.) and regulations (29 CFR 1902 - 1910) and National Fire Protection Association recommendations. The Air Force Safety Center develops Air Force Environmental and Occupational Safety and Health (AFOSH) standards that implement OSHA rules directed by DoDI 6055.1 and AFI 91-302. The Center also develops other guidance to supplement the AFOSH standards and ensure their availability at the supervisor and worker level. The goal is to ensure that guidance is in compliance with OSHA and other federal standards and to incorporate "lessons learned" and appropriate parts of consensus standards to provide the supervisors and workers with the tools necessary to prevent mishaps. Their function is provide guidance, evaluate compliance, provide technical expertise in a wide range of subjects, coordinate with other agencies and private entities in and outside of the federal sector, and perform engineering reviews of procedures and facility design projects (USAF 2004a).

The SHE standards establish consistent approved direction for implementation of safety policy and define requirements and procedures for all activities. The purpose of the standards is to prevent accidents and associated losses from injury or illness, equipment damage, test unit downtime, and environmental damage. These standards delineate the command policies and procedures concerning safety for all activities, including definition of safety organizations, requirements for all programs, methods for establishing safety criteria, and the formulation of safety plans and operational controls and procedures. Arnold AFB SHE Standards are categorized below.

- Safety Administrative Standards, which provide basic safety requirements and guidance for establishing safety criteria, procedures, and program elements;
- Work Environment Standards, which are the required procedures and administration to assist in the prevention of accidents and associated looses from injuries or illnesses;
- Work Operation Standards, which are the “how-to” procedures for accomplishing certain critical work tasks;
- Equipment and Systems Standards, which provide safe operating procedures for various systems, equipment, and tools;
- Toxic and Hazardous Substances Standards, which provide safe operating procedures for storage, handling, use, and disposal of toxic and hazardous materials; and
- Personal Protective Equipment (PPE) Standards, which define PPE requirements.

Final authority and responsibility for all aspects of safety at AEDC rests with the Center Commander. Safety is administered by the Chief of Safety (AF/SE) and supported by staff and organizations with specific areas of expertise and responsibilities, including the Base Environmental Engineer and testing contractor safety organization. The ESHQ team is responsible for environmental and occupational safety at

Arnold AFB including ongoing evaluations for noise, ergonomics, hazard communication, personal protective equipment and emergency response.

The safety process for test and maintenance operations begins when a request is submitted to use a test facility or to conduct other activities. The requesting organization is required to submit a written risk analysis that includes a detailed description of the activity and the methods to be used. A Safety and Health Working Group, which includes safety staff, asset managers, system engineers, and other representatives relevant to the activity, convenes to review the draft risk analysis, identify hazards associated with the proposed activity, formulate processes to eliminate or minimize hazards, and establish an appropriate risk level. Findings are documented in a System Safety Hazard Analysis. Comprehensive training is conducted at AEDC to ensure that all staff is familiar with general health and safety requirements and facility- or activity-specific processes and procedures.

3.2.2.1 Industrial Hazards

Industrial hazards are associated with testing operations, general base activities, maintenance, and construction and demolition associated with new, modified, and obsolete facilities. Industrial hazards associated with testing and support functions include operation of large machinery and equipment, crane operations, machine and tooling operations, high voltage equipment, high pressure steam, vacuum and pressure chambers, confined spaces, cryogens and other gases, hazardous materials, pinch points, heights, lifting, transportation, noises, and slips, trips and falls. Hazards associated with construction and demolition include common industrial hazards as well as earth moving equipment, fugitive dust, excavations, falling debris from demolition, and exposure to contaminated materials. All operations, construction, and demolition activities at AEDC are conducted in adherence with Air Force guidelines, AEDC health and safety plans, site- and project-specific work plans, BMPs, and applicable laws and regulations. Health and safety measures to mitigate risks include training, work place monitoring, administrative controls, engineering controls and use of PPE as appropriate.

3.2.2.2 Emergency Response, Fire and Explosion

The AEDC Fire Department is responsible for all fire, rescue, hazardous materials, and emergency medical service operations on base. It also provides training and performs annual inspections of facilities. The department provides Advanced Life Support (paramedic) Service; it employs approximately 50 emergency professionals, all of which are certified DoD firefighters with many trained as paramedics. Emergency Medical Technicians, or EMT IVs, have at least minimum training as First Responders.

AEDC has mutual aid agreements with Coffee and Franklin Counties. If needed, a minimum of 20 ambulances could be on a scene within 45 minutes. Medevac helicopters are available from Vanderbilt Hospital in Nashville and Erlanger Medical Center in Chattanooga, as well as from hospitals in Huntsville, Alabama and Fort Campbell, Kentucky.

Fire training exercises are performed twice per year and include the use a smoke house, which simulates smoke using a fog machine, and a fire training pit, which is equipped with a propane-induced, remotely-controlled flame. Wildland fire training is conducted in conjunction with the Forest Service. Hazardous materials practical exercises are conducted twice per year, including fuel spill simulations, fuel storage tank fire, and aircraft fire training.

The nature of the AEDC mission and materials use result in potential risks associated with fire and explosion. The fire protection system includes the fire department building, one 250,000-gallon elevated storage tank, 93,800 feet of fire-fighting water mains, 162 fire hydrants on the potable water system and 22 hydrants and 33 deck guns on the raw water system, associated flow meters and control gate valves outside of buildings, and fire observation towers. A variety of built-in fire protection systems are in use at AEDC, including 43 Halon 1301 systems, 171 hose standpipes, 32 low pressure CO_2 system, 28 high-pressure CO_2 systems, one wet chemical and two dry chemical installations, 100 fire detection systems, one high-expansion foam system, and 53 manual fire alarm systems. There are 361 zones that report into the Fire Department's central station receiver through an integrated system.

The base only maintains materials that are required for test projects at AEDC and does not provide long-term storage of explosives. The DoD Explosive Safety Board approves the locations of all explosive storage facilities at AEDC.

Numerous AEDC facilities such as the test cells and propellant storage tanks have the potential for large-scale destruction should uncontrolled detonation of explosive materials occur. Quantity distance (QD) separation zones are established to limit development around hazardous facilities. The intraline zone delineates the minimum distance that all non-test essential personnel (administrative, secretarial, and maintenance personnel) must maintain during actual test operations. The inhabited building distance zone, or the outer-most area, is the minimum distance that personnel not associated with the potentially explosive test facility must maintain at all times. Inhabited buildings are not permitted with this outer-most zone. Air Force Manual 91-201 establishes the size of the clearance zones based upon QD criteria or the category and weight of the explosives.

There are two known projectile impact areas where field-weapons training was conducted during World War II. Because exposed projectiles or unexploded ordnance (UXO) may still remain in these areas, safety clearances are required for entry. The TNARG also has operatives a live firing range for training exercises located on several miles from the AEDC complex.

3.2.3 Noise

Noise in the context of this EA refers to sounds generated by base activities that could affect base employees, on-base residents, off-base residents or commuters, or wildlife.

Noise levels typically are expressed in terms of decibels (dB). For determination of impacts to human receptors, noise measurements are weighted to increase the contribution of noises within the normal range of human hearing and decrease the contribution of noises outside of the normal range, resulting in the A-weighted scale (dBa). Noise levels in suburban neighborhoods are typically around 50 dBa to 60 dBa (dB Engineering 2004). A quiet office or rural home typically has a noise level of approximately 40 dBa (League for the Hard of Hearing, 2004). The scale used to measure generated sound pressure is logarithmic rather than arithmetic, as a combination of noise sources results in only incremental sound pressure. For example, when sound pressure doubles, the dBa level increases by about 3.

Typically, sound level is doubled when the distance from the source is halved and, conversely, the sound level is doubled with halving of the distance. Additionally, people tend to exhibit differing sensitivity to noises generated by time of day, with noise at night being more disturbing than daytime noise. Therefore, a Day-Night Average Noise Level (DNL) is used to determine whether noise would be perceived as an adverse impact. Noise levels in typical urban residential areas range from 58 dBa to 72 dBa (USACE 1998). The USEPA does not recommend residential development where the DNL values exceed 65 dBa.

USEPA has identified acceptable average noise levels for various land uses (USEPA 1974), and the USAF has established land use noise compatibility criteria consistent with those published by the Federal Interagency Committee on Urban Noise (FICON) in its publication, *Guidelines for Considering Noise in Land Use Planning and Control* (FICON 1980). The USAF DNL noise level criterion is 65 decibels as the threshold of incompatibility for residential and other noise-sensitive land uses, such as schools, hospitals, and religious facilities in the vicinity of Air Force bases. The FAA applies the same criterion level to noise-sensitive areas around the nation's civilian airports.

AEDC testing operations generate significant sound levels. Major noise sources include the ETF A, B, and C plants and test cells, the PWT complex, the VKF compressor facility, and Tunnels A, B, and C. Day-to-day levels vary widely depending on the test workload, but can frequently exceed 100 dBa for extended periods at some locations within theses facilities. Table 3-6 provides noise levels from various test facility measured from the AEDC gates and fence line, and Figure 3-8 shows theoretical maximum noise contours for AEDC.

The criterion for the AEDC boundary for determination of significance is 70 dBA averaged over 24 hours, which is considered the upper threshold to prevent measurable hearing loss over a lifetime. The AEDC complex test facilities are centrally located within the 40,000-acre Base with adequate separation from surrounding communities to reduce maximum noise levels to less than approximately 75 dBa (AEDC 2005a). Approximately 5,000 acres of pine plantations at the base were established primarily for sound attenuation.

Table 3-6. Representative Noise Levels AEDC, Arnold AFB, TN.

Noise Source	Noise Measurement Location (value reported in dBA)				
	Main Gate	Gate 1	Gate 2	Maximum at AEDC Fence	Other Location
PWT					
4T Aerodynamic Test	54	60	62	62	
16T Aerodynamic Test, Mach 0.8	64	60	71	71	
16T Aerodynamic Test, Mach 1.2	71	55	72	72	
16T Aerodynamic Test, Mach 1.6	61	60	73	73	
16T Aerodynamic Test					106 (PES Yard Area)
					89.3 (500 ft from source)
					84.2 (1,000 ft from source)
16T Aerodynamic Test, VKF Compressors	52	53	76	76	
VKF					
Tunnel A	57		62	64	
APTU – Atmospheric Bleed	83	81	93	93	119 (ETF)
APTU – Vent Through Test Cell	69	67	79	79	98 (ETF)
ETF/VKF/PWT Combinations					
J-1 (ETF) & Tunnel A (VKF)	54	28	62	62	
J-1 (ETF) & Tunnel A (VKF) & 16-T (PWT)	70	36	72	75	

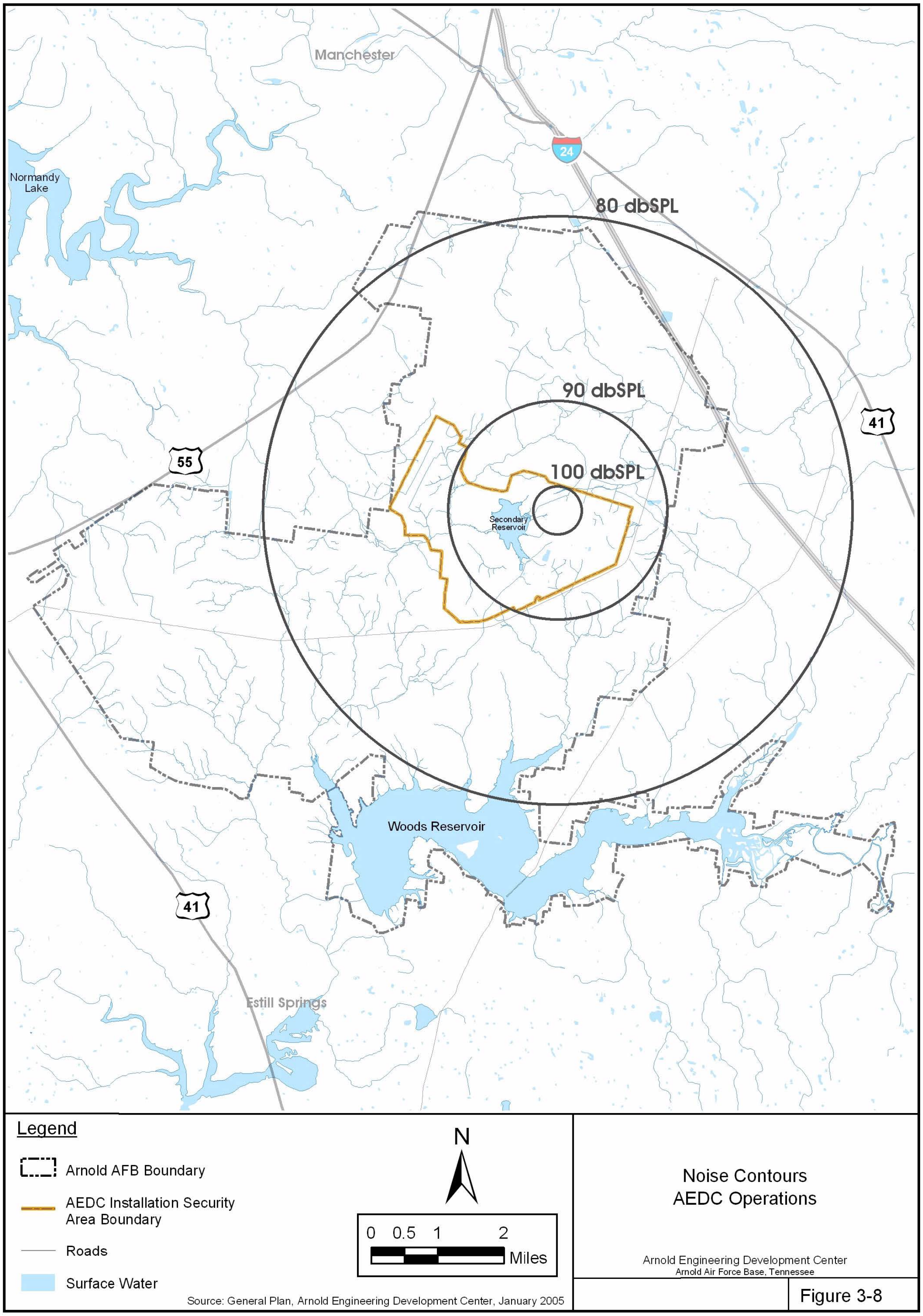


Figure 3-8. Noise Contours

3.2.4 Hazardous Materials and Solid and Hazardous Waste Management

Testing and supporting operations at AEDC require the use of hazardous and non-hazardous materials and result in the generation of solid and hazardous wastes. Materials required for operations include testing fuels, heating fuels, transportation fuels, oils and lubricants, chemicals for water treatment, refrigerants, gases, paints, solvents, and numerous other substances and products. Wastes generated from AEDC operations include solid waste, hazardous wastes as defined under RCRA, and other regulated wastes including asbestos-containing materials (ACM) and PCBs derived from building demolition and equipment repairs. The processes and procedures for handling and disposing of these materials and wastes are defined in various basewide and AEDC-specific plans. Hazardous material and solid and hazardous waste management are summarized in the following sections.

3.2.4.1 Solid Waste Management

Management of solid waste is conducted in accordance with the Solid Waste Management Plan (AEDC 2005). Scrap metal, most of which is salvaged and sold, represents the single largest volume of generated solid waste, followed by construction debris. These two categories make up approximately 75% of the municipal solid waste generated at AEDC. Table 3-7 summarizes recycling and solid waste disposal volumes for CY 2001-2005.

Municipal and non-process industrial type wastes are transported to a commercial waste transfer station about 11 miles from AEDC. A municipal waste service contractor transports waste from this transfer station to a sanitary landfill located in Rutherford County, approximately 55 miles from AEDC. Medical wastes are collected, transported, and disposed of at appropriate facilities by a commercial medical waste management company. Most plastic and print media containing classified or sensitive information is shredded using a special shredding machine. Plastic to large to shred and magnetic media is incinerated at an on-base facility.

Table 3-7. Recycling and Soil Waste Disposal Volumes
CY2001 - 2005

Category	Average (tons)	Minimum (tons)	Maximum (tons)
Solid Waste Disposal	**834**	**736**	**967**
To Landfill	828	735	957
To Incinerator	6	2	9
For Thermal Recovery	0	0	0
Solid Waste Composted On-Site	**5**	**0**	**11**
Solid Waste Composted Off-Site	**0**	**0**	**0**
Solid Waste Mulched	**0**	**0**	**0**
Solid Waste Recycled On-Site	**1,644**	**979**	**2,569**
Aluminum Cans	0	0	0
Steel Cans	0	0	0
Card Board	141	121	159
Newspaper	106	83	127
High Grade Paper	0	0	0
Glass	0	0	0
Plastics	0	0	0
Wood	0	0	0
Steel Scrap	1,317	653	2,206
Non-Ferrous Scrap	0	0	0

Category	Average (tons)	Minimum (tons)	Maximum (tons)
Tires	5	3	11
Other	75	52	89
Solid Waste Recycled Off-Site	**1**	**1**	**2**
Solid Waste Reused	**0**	**0**	**0**
Solid Waste Donated	**0**	**0**	**0**
Construction Debris sent to Landfills	**32,458**	**3,996**	**135,850**
Construction Debris Recycled	**178**	**78**	**286**

Arnold AFB has two active, permitted landfills: the Construction Debris (C&D) Landfill, which receives wastes generated from on-base construction and demolition activities, and an Asbestos Landfill, which receives ACM wastes from facility maintenance and demolition, equipment repairs, and other activities. ACM wastes are segregated and appropriately packaged for disposal.

Some wastes, such as oily sludge, solids mixed with free liquid, and wastewater that does not meet pre-treatment requirements for base wastewater treatment facilities are disposed of through the Defense Reutilization and Marketing Office (DRMO). DRMO contracts with commercial waste management companies to transport these wastes to appropriate disposal facilities. Other "special wastes" may be disposed of in the C&D Landfill or local commercial sanitary landfill as appropriate; disposal of special waste requires certification from TDEC. Other regulated wastes, such as asbestos, lead-based paint, and PCBs, are controlled through specific management programs such as the Asbestos Management and Operations Program, the AEDC Lead and Heavy Metals Management Program, and various AEDC Safety, Health and Environmental Standards.

Arnold AFB maintains a base-wide reduction, reuse, and recycling program set forth in the Solid Waste Management Plan. This program includes recycling of paper, cardboard, scrap steel, and used oil. The recycling program includes ongoing communication with and education of base personnel and the public regarding the benefits of waste reduction and reuse.

3.2.4.2 Hazardous Material and Waste Management

AEDC testing and supporting operations and maintenance require the use of various hazardous materials and result in the generation of chemical wastes. Hazardous material is defined as new or used product, chemical, or substance capable of producing adverse effects to health, safety, or property when transported, spilled, stored, handled, or used (AEDC 2005). A partial listing of hazardous materials used, by category, is provided below. Appendix I provides a comprehensive list of hazardous materials managed at Arnold AFB.

- Adhesives, including epoxy, glues, adhesive accelerators, and construction adhesives;
- Anti-freeze, including ethylene and propylene glycol;
- Building materials, including caulking, sealants, insulation, foams, roofing tar, joint sealants, PVC primer and cement, silicone sealants, sealing compounds, and thread sealants and lockers;
- Chemicals, including acetone, caustic soda, chlorine, hexane, hydrochloric acid, isopropyl alcohol, methanol, methyl ethyl ketone (MEK), nitric acid, sodium carbonate (soda ash), sodium hydroxide, and sulfuric acid;
- Fertilizers;
- Office supplies, including toner and cleaning solutions;

- Paints, primers, sealants, varnish, thinners, paint removers, and screen inks;
- Pesticides, including biocides, herbicides, insecticides and insect repellants, rodenticides, fungicides and algaecides;
- Petroleum products, including jet fuel, diesel/No. 2 fuel oils and additives; gasoline; greases, hydraulic oil, liquid petroleum gas (propane), lubricating oils (pump oils, lubes, chain oils, etc), motor oils, penetrating oils, and starting fluids;
- Photographic supplies, including developer, fixer, and film cement;
- Refrigerants, including freon 22, 113, 500, and 502;
- Solvents (degreasers); and
- Welding and soldiering supplies, including acetylene, compressed oxygen, and brazing flux.

Hazardous materials and hazardous waste management activities at Arnold AFB are coordinated with EPA, Region IV, in accordance with CERCLA, 42 USC 9601-9675, as amended, and RCRA, 42 USC 9601-6992, as amended. In general, this includes substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristics, may present substantial danger to public health or welfare or the environment when released into the environment.

Hazardous materials are managed through the HazMat Pharmacy (Facility 1459). Requirements for the hazardous materials program are defined in the Hazardous Materials Distribution Plan for the AEDC HazMat Pharmacy (AEDC 2005). The HazMat Pharmacy and the Hazardous Waste Operations Group use a computer database system to manage the purchase, distribution, and use of hazardous materials and the disposal of hazardous Wastes. The system is designed to monitor the location and quantity of all hazardous materials used. Hazardous materials that have surpassed their shelf-life, are in an unserviceable condition, or are no longer needed are turned in to the DRMO for management in accordance with the base *Hazardous Waste Management Plan* (AEDC 2007).

Hazardous wastes typically stored at AEDC are listed according to the characteristic waste type, hazard classification and associated EPA number. Hazardous waste is collected in labeled containers at the site of generation or at an initial accumulation point (IAP) (Figure 3-9). Up to 55 gallons of hazardous waste or one quart of acutely hazardous waste may be stored at an IAP before being collected by HWOG, in accordance with RCRA. From the IAPs, hazardous waste is transferred to one of three 90-day accumulation points. Within 90 days, this waste is transferred to a Transportation, Storage, and Disposal Facility (Building 1456) which is a TDEC permitted storage facility operated in accordance with RCRA requirements. The permit for storage of hazardous wastes at AEDC includes both administrative and engineering controls to prevent releases. Additionally, the *Spill Prevention and Response Plan* establishes procedures for spill prevention, response, and notification. Final disposition of hazardous waste is managed by the DRMO at Anniston, Alabama for appropriate transportation, treatment, and disposal in accordance with RCRA requirements.

The volume of hazardous materials used and hazardous waste generated annually varies depending on a number of factors, including the number and types of tests performed, the O&M performed at testing units and support facilities, the generation of one-time waste streams, and other operational variables. The range for annual hazardous waste generated, stored, transported, and disposed of is about 22 to 38 tons per year. Appendix H provides a detailed summary of hazardous waste generated by source for CY2000-2005 and lists the major hazardous waste generators in order of volume.

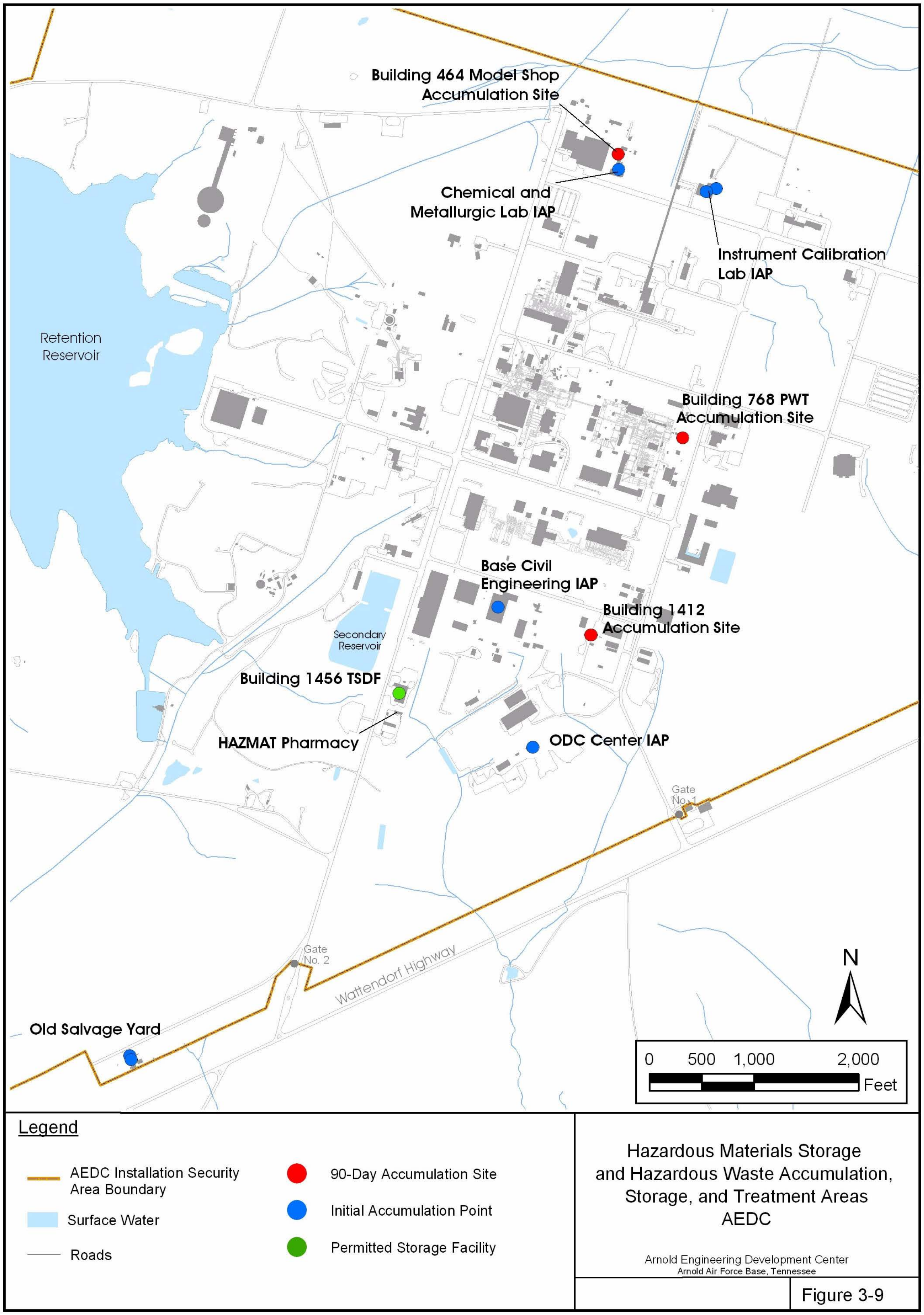


Figure 3-9. Hazardous Materials Storage and Hazardous Waste Accumulation Storage, and Treatment Areas

The base has a *Compliance Through Pollution Prevention Management Action Plan* (AEDC 2005b) to reduce the use of hazardous materials and consequent generation of hazardous waste. This plan lists materials targeted for reduction with suggestions for substitution. Pollution prevention initiatives minimize the hazardous waste disposed by eliminating or reducing the hazardous source material and recycling or reuse. Initiatives implemented to date include a used oil recycling program; improved processing of oil-soaked absorbents, aerosol cans, and excess materials; an 80 percent reduction of the hazardous waste generated from paint stripping through use of a portable blasting machine by the paint shop; and conversion to environmentally-friendly pesticides and fertilizers.

AEDC has a formal training program for personnel involved in the handling, storage, and management of hazardous waste (AEDC 2007). Training is designed to ensure that wastes are properly collected, containerized, labeled, accumulated, handled, stored, and managed, and that employees can react properly to emergency situations.

3.2.4.3 Spill Prevention and Response

Spills and leaks can contaminate air, soil, surface water, sediments, or groundwater. Avoiding spills and leaks is preferable to remediation after they occur, both from an environmental standpoint and because of the increased effort and cost associated with response and cleanup. The AEDC Spill Prevention Controls and Countermeasures Plan (SPCC) (AEDC 2008) is designed to prevent environmental contamination by oil spills, and is intended to fulfill the requirements for a Spill Prevention Control and Countermeasures Plan. The SPCC complies with the requirements of the CWA as amended (33 U.S.C. 1251 et seq.). In addition, it addresses the requirements of the Oil Pollution Act as described in 40 CFR 112. The SPCC includes details concerning preventative and containment measures and is designed to minimize risks to human health and the environment (AEDC 2008).

BMPs for spill prevention and response include implementing the requirements of the most current SPCC Plan; identifying potential spill areas and drainage routes; providing engineering controls such as leak detection, oil/water separators, and skimming ponds; educating employees; conducting site-specific planning; evaluating spill impacts; and evaluating spill response procedures.

Spill response is divided into four basic phases: prevention, control, countermeasure, and corrective action, and includes site-specific planning and inspections, response actions, equipment and manpower requirements, contingency planning, community right-to-know, and training.

Spill response actions are categorized below.

- Containment and countermeasures, wherein the spilled material is controlled to minimize harm to human health and the environment. Procedures are provided both for specific areas and specific contaminants;
- Cleanup and disposal, wherein the contaminant is removed from the environment or treated to render it harmless; and
- Corrective actions, wherein the situation is evaluated, and new procedures developed and employees trained as appropriate to prevent a recurrence.

A comprehensive review of the SPCC is conducted as directed by 704 CEV/CEA, at a minimum of every three years.

3.2.5 Installation Restoration Program

The USAF developed the Installation Restoration Program (IRP) to clean up and control contamination created from past waste disposal activities and practices at military installations. This comprehensive program is designed to identify, investigate, and remediate contaminated sites, and has as its focus to protect human health and to ensure that natural resources are restored for future use. Implementation of the IRP at Arnold AFB is the responsibility of AF/SDE with support activities performed by the base support contractor. A Facility Action Plan is updated periodically to summarize the status of the IRP and to outline the comprehensive long-range goals and strategies for conducting environmental restoration. Arnold AFB executes the IRP in consultation with TDEC in accordance with CERCLA and RCRA (AFI 32-7020).

Since its implementation at Arnold AFB in 1982, 26 IRP sites have been identified, 8 of which have been closed after determinations of no further action. Of the remaining sites nine are active undergoing interim remedial action operations, eight are closed with Land Use Controls (LUCs) in place, and one is in long-term operation with long-term monitoring requirements in place. Arnold AFB IRP sites are listed in Table 3-8 and shown in Figure 3-10.

The AEDC RCRA Part B permit requires the identification, investigation, remediation, and eventual close-out of all solid waste management units (SWMUs). A Facility Action Plan (FAP) implements the AEDC approach of managing all SWMUs within the AEDC industrial area. Other SWMUs outside the area are managed independently in accordance with the FAP. The FAP is regularly updated as part of the IRP process.

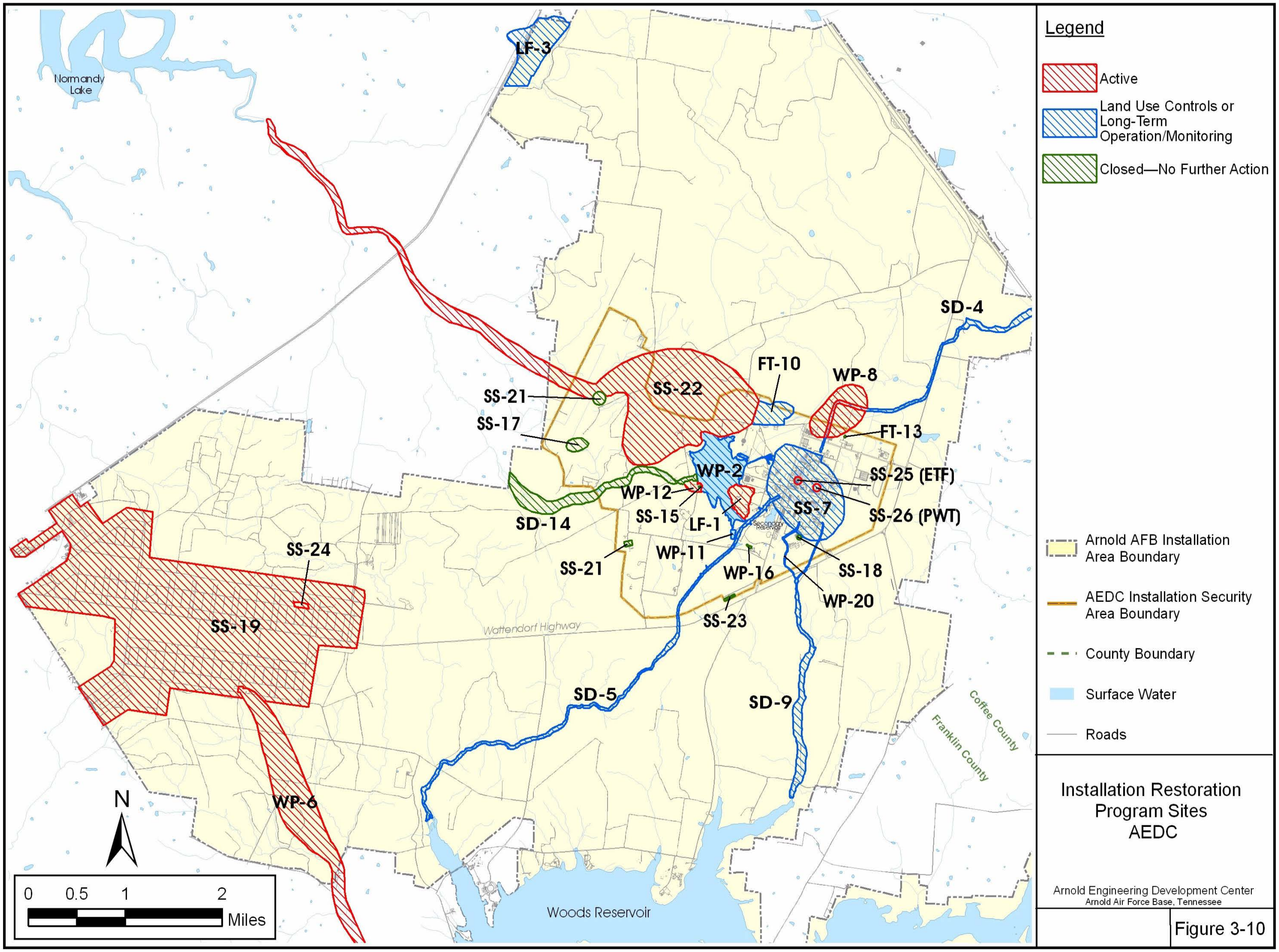
Table 3-8. Installation Restoration Program Sites

Site No.	Description	Status
LF-1	Leaching Pit 2/Landfill No. 2	ACTIVE
WP-2	Retention Reservoir (SWMU 3), J-4 Surface Drainage (SWMU 4)	LUC
LF-3	Coffee County Landfill (SWMU 5)	LTO/LTM
SD-4	Bradley Creek Drainage Area	LUC
SD-5	Rowland Creek Drainage Area (SWMU 7)	LUC
WP-6	Camp Forrest Water Treatment Plant (SWMU 24)	ACTIVE
SS-7	AEDC Main Testing Area	LUC
WP-8	Leaching Pit No. 1 (S SWMU 6)	ACTIVE
SD-9	Brumalow Creek Drainage Area (SWMU 11)	LUC
FT-10	FORMER FIRE TRAINING AREA/LANDFILL BURN AREA (SWMU s 12, 13 and 14)	LUC
WP-11	Chemical Treatment Pond	LUC
WP-12	Retention Leach/Burn Area (SWMU 16)	ACTIVE
FT-13	Fire Protection Training Area 1 (SWMU 17)	CLOSED-NFA
SD-14	Crumpton Creek Surface Draining Area (SWMU 18)	CLOSED-NFA
SS-15	High Energy Fuel Burn/Burial Area	CLOSED-NFA
WP-16	Beryllium Leaching Area (SWMU 20)	CLOSED-NFA
SS-17	Burn Area 2 (SWMU 21)	CLOSED-NFA
SS-18	M&K Warehouse	CLOSED-NFA

Site No.	Description	Status
SS-19	Camp Forrest Site (SWMU 24)	ACTIVE
WP-20	Steam Plant Ash Pits (SWMU 25)	LUC
SS-21	Hazardous Waste Storage	CLOSED-NFA
RCRA (22)	Corrective Action Solid Waste Management Units	ACTIVE
SS-23	Old Salvage Yard Asbestos Area	CLOSED-NFA
SS-24	Camp Forrest Asbestos Landfill Area (SWMU 24)	ACTIVE
SS-25	Engine Test Facility Area	ACTIVE
SS-26	Propulsion Wind Tunnel Facility	ACTIVE

ACTIVE – Indicates Investigation or interim measure in progress
FT – Fire training areaI
RP – Installation Restoration Program
LF – Landfill site
LTO/LTM – Long-term operation/long-term monitoring
LUC - Land use controls
NFA – No further action
RCRA – Resource Conservation and Recovery Act
SD – Sediment Site
SS – Spill site
WP – Waste pile/pit

Figure 3-10. Installation Restoration Program Sites


Legend
Active
Land Use Controls or Long-Term Operation/Monitoring
Closed—No Further Action
Arnold AFB Installation Area Boundary
AEDC Installation Security Area Boundary
County Boundary
Surface Water
Roads
Installation Restoration Program Sites AEDC
Arnold Engineering Development Center
Arnold Air Force Base, Tennessee
Figure 3-10
Normandy Lake
LF-3
SD-4
FT-10
WP-8
FT-13
SS-21
SS-22
SS-17
WP-2
SS-25 (ETF)
WP-12
SS-15
LF-1
SS-7
SS-26 (PWT)
SD-14
SS-24
WP-11
SS-21
WP-16
SS-18
WP-20
SS-23
SS-19
Wattendorf Highway
SD-5
SD-9
Coffee County
Franklin County
WP-6
N
0 0.5 1 2
Miles
Woods Reservoir

4.0 ENVIRONMENTAL CONSEQUENCES

The impacts associated with operations at AEDC can be segregated into three basic categories or assets: utility, test, and plant; however, the assets may or may not operate independently. Many of the utility assets operate at some level continuously to provide support to the base infrastructure. Plant assets may operate at a reduced level although no test assets are in operation in order to maintain the test units in a state of readiness. This section will evaluate the impacts of each category and also consider the cumulative impacts of the assets when they are configured for test purposes.

The environmental consequences for the Proposed Action and the No Action alternative are differentiated by the annual test operations of the facilities. Section 4.1 addresses environmental consequences associated with operations similar to those conducted from FY2002 to FY2005 which is the No Action Alternative as well as the Proposed Alternative of increased test asset operation.

Cumulative impacts for the no-action and proposed action are addressed in Section 4.2.

4.1 AEDC Operations

Current operation levels at AEDC constitute the No-Action Alternative. As discussed in Chapter 2, the base infrastructure and safety, health and environmental management systems are common to the Proposed Action and No Action alternative. The impact of utility assets will be similar for both alternatives; however, the impact from test and plant assets will be significantly more for the Proposed Action.

The potential impacts to the water resource are presented for each plant asset to evaluate unique features and consequences. As discussed in Chapter 2, the cooling water system for AEDC is essentially a closed-looped system in which raw water from Woods Reservoir is pumped to the secondary reservoir, circulated to the testing units, and then recirculated to return pipes, return ditches, pumpback systems, or the retention reservoir. Discharged cooling water, treated wastewater, and stormwater are monitored at NPDES outfall locations to ensure compliance with the Arnold AFB NPDES permit.

The Arnold AFB Title V Major Source Operating Permit (No. 546264) addresses conditions for specific air emission sources within the individual test complexes and conditions applicable throughout AEDC. The airshed region within which AEDC lies is an “attainment” area, and the Arnold AFB permit conditions are established to ensure that operations comply with NAAQS to continue maintenance of regional air quality. The following subsections present the emissions from recent operations compared to the Title V permit allowances. Air emissions not specifically addressed in the permit are also addressed.

The analysis of current operations addresses common elements to Proposed Action and No Action alternatives. Impacts to the natural and human environment associated with increased facility operations are addressed in Section 4.2, *Future Operations*.

4.1.1 Summary of AEDC Integrated Operation and Interfacing Systems

AEDC operates the Center’s complex arrangement of systems through a Mission Operations Control Center (MOCC) process and standard base Computerized Maintenance Management System (CMMS) that allows the Operating Contractor to oversee and direct on-going test cell, plant, utilities and support operations with a significantly high level of control and integration. On a daily basis, the government oversees the planning and scheduling performed by the Operating Contractor to set priorities for test and to resolve work conflicts. Environmental concerns and issues are worked real-time to assure weather, test conditions, "inputs and outputs" of the test systems and processes are effectively and efficiently managed.

This section presents a summary of AEDC-asset inputs and outputs. Plant asset inputs and outputs are addressed in Sections 4.1.2 through 4.1.4. AEDC utility assets are presented Table 4-1 for calendar years CY 2000 through 2005, including electrical power, raw water, natural gas, petroleum fuel (jet fuel, diesel, and gas), and liquid and solid propellants. Appendices J and K provide more detailed information on system inputs.

Clear distinction of all inputs and outputs by test asset can not be made as plant and utility assets can be configured multiple ways to provide optimum support. Also, some system inputs are not measured and reported on an annual basis because of inconsequential volumes or infrequent nature of their use, such as gases for explosion and fire protection, closed system components with inconsistent refilling (e.g., hydraulic oils), or inconsistent use of equipment requiring component replacement (e.g., desiccants). Test assets are performed only a fraction of the total time available. The frequency of test assets can be sporadic, and in some cases a test asset or plant asset is not operated for an entire year. Accordingly, the use of resources can vary significantly from year to year.

In addition to the utility demands from the test assets, the AEDC complex also requires utilities for daily operations. Utility use for general operations and support facilities often outweighs use for the test assets. For example, average annual AEDC electrical power demand is nearly equal to the average total annual electrical power supplied to all of the AEDC test assets, with approximately 200,000 MW-hr/yr for all test assets compared to 180,000 MW-hr/yr for other uses. However, the electrical peak demand is much higher for test assets.

The primary use of natural gas is for steam production. Test assets require an average direct use of 30 million cubic feet (MCF) per year of natural gas for operation of heaters and driers, with the steam plants requiring approximately 584 MCF, about 95% of the total natural gas demand. Of this amount, the low-pressure steam supply system (Steam Plant A), which provides steam for non-test industrial facility heating as well as some test operations such as fuel conditioning systems, uses about 98% of the natural gas. The high-pressure steam supply system (Steam Plant C) accounts for the remaining 2% of the natural gas usage.

Jet fuel is used primarily for turbine engine testing. Commingled fuel, which is off- specification jet fuel or fuel consisting of mixtures that remain after testing or system purging, is used for operation of the ASTF heaters or at Steam Plant A. Base operations also use diesel fuel and gasoline for its vehicle fleet, including heavy equipment, heavy and light duty trucks, locomotives, cars, and landscape equipment. The average petroleum fuel use for test assets averages approximately 1,626,000 gallons per year, with the remainder of the base using an average of approximately 1,000,000 gallons per year.

While test assets using jet fuel are consistently operated at AEDC, tests using liquid or solid propellants have been rare in recent years. No use of solid propellants was reported in the period 2000 through 2005. Liquid hydrogen and liquid oxygen (cryogenic propellants) were last used in 2001, but in very small quantities. The last reported use of hypergolic fuels (hydrazine class fuels and nitrogen tetroxide oxidizer) was in 1996.

Raw water usage for the AEDC totals an average of 29 billion gallons per year. Approximately 8.2 billion gallons per year is pumped from Woods Reservoir on average, with approximately 9.6 billion gallons of spent cooling water recirculated from the retention reservoir and the remaining 11.3 billion gallons recirculated in the ASTF cooling tower system. Approximately one-third of the annual raw water demand at the AEDC is supplied from Woods Reservoir with the remaining two-thirds consisting of recirculated water.

Table 4-1. AEDC Average Annual Facility Inputs for CY 2000 - 2005

System Input	ETF	VKF	PWT	Base Total[1]
Electrical Energy (MWh-yr)				
Average	106,007	7,179	86,342	379,799
Minimum	28,067	633	40,145	339,903
Maximum	226,875	17,553	126,673	445,953
Raw Water (Mgal/yr)				
Average	7,061	402	6,216	29,187
Minimum	2,426	49	3,125	24,494
Maximum	14,005	1,095	8,641	37,331
Natural Gas[2] (MCF/yr)				
Average	24,272,850	2,412,333	7,307,667	603,892,483
Minimum	936,000	0	1,974,000	560,748,900
Maximum	53,065,400	7,605,000	15,092,000	644,248,000
Jet Fuel (Mgal/yr)				
Average	1,625,976	0	0	2,679,901
Minimum	229,044	0	0	1,341,604
Maximum	3,193,585	0	0	3,886,758
Liquid Propellants (gal/yr)				
Average	0	0	0	0
Minimum	0	0	0	0
Maximum	0	0	0	0
Solid Propellants (lb/yr)				
Average	0	0	0	0
Minimum	0	0	0	0
Maximum	0	0	0	0
Steam (lb/yr)[1]				
Average	25,939,370	9,768,863	93,000	423,076,828
Minimum	20,022,000	2,676,000	0	385,039,000
Maximum	37,061,000	36,217,000	316,000	455,289,000
Hours of Operation (hr/yr)				
Average	796	91	3,666	0
Minimum	0	0	474	0
Maximum	2,606	315	11,698	379,799

gal/yr – gallons per year
lb/yr – pounds per year
MCF/yr – million cubic feet per year
Mgal/yr – million gallons per year
MWh/yr – megawatt-hours per year
NA – not applicable

1 – Base usage is the total AEDC complex usage excluding the testing operation usage.

As these volumes indicate, cooling water is recycled multiple times through the system. Seasonal water temperature fluctuations change the proportion of water pumped from Woods Reservoir. More water can be recirculated during cold weather conditions while still providing adequate cooling. During warmer conditions, more water is pumped from Woods Reservoir to maintain adequate cooling. Maximizing the amount of recirculated cooling water reduces costs associated with pumping water from Woods Reservoir and also reduces water discharges from AEDC and associated environmental impacts.

The release of water from the AEDC is controlled through compliance with the AEDC NPDES permit (TN0003751). Monitoring is performed at internal points within the AEDC complex to ensure that the water from test assets is appropriate for discharge, and at NPDES outfalls to ensure protection of water resources in accordance with permit conditions. Table 3-2 summarizes the NPDES requirements and compliance history for each outfall location for CY 2000 through 2005 and Appendix E provides additional data for the same period.

Air emissions from the AEDC are regulated under the Clean Air Act Amendments and specifically controlled through compliance with the AEDC Title V Major Source Operating Permit (546264). This permit includes an administrative Amendment #1 dated August 2003, Minor Modification #1 dated May 2003, and Minor Modification #2 dated May 2003. The AEDC operates in strict compliance with the requirements and conditions of the permit and its modifications. Table 3-5 summarizes air emissions for CY 2000 through 2005, and Appendix G provides additional data for the same period. All facilities constructed prior to the Trenton Cells (test assets SL2 and SL3) were not subject to Prevention of Significant Deterioration (PSD) analysis. However, when the Title V permit was issued, the limits sets for these test assets was deemed adequate to not cause significant impact on the air quality. ETF C-plant and the associated test assets (C1 and C2) as well as DECADE and J6 were constructed after the PSD analysis requirements; however, the emission limits requested and approved were below PSD threshold levels and a PSD analysis was not required.

Many of the permit conditions are based on the maximum rated operational limits of the regulated equipment by virtue of the maximum hourly heat generation of the unit or limitation to the type or quality of fuel used. These conditions apply to compliance for most NAAQS pollutants (CO, NOx, SOx, and PM) as well as VOCs. Steam Plant A boilers emit approximately 1% of the SOx allowed under the permit (Condition E4-8), with the maximum annual hours of operation of the Steam Plant A boilers at 74% of the limit (Condition E4-3). Consequently, the allowable hours of operation will limit the steam production before the SOx limit is reached. For other emission sources, either annual or hourly limitations on fuel use are the limiting factor. Limitations on operational hours and fuel use are set for all operations to ensure that emissions are managed consistently with the requirements of the Title V permit.

The volume of non-hazardous and hazardous waste generated annually at AEDC varies depending on a number of factors, including the number and types of tests performed, the O&M performed at testing units and support facilities, one-time waste streams, and other operational variables. The general range for annual hazardous waste generated, stored, transported, and disposed is approximately 20,000 kilograms to 35,000 kilograms (22 to 38 tons) per year. Figure 3-9 and Appendix H provide details on hazardous waste generation.

Impacts from noise generated by AEDC operations are common to the Proposed Action, No Action alternative, and to all testing and general base operations. The AEDC safety program includes mandatory hearing protection for its workers exposed to noise levels exceeding 85 dBA. Engineering controls such as physical barriers, acoustic sound insulation, and acoustic rooms attenuate noise within buildings. Natural conditions including vegetation and topography help to further attenuate the noise levels. Measured noise levels associated with AEDC operations are provided in Table 3-9 and Figure 3-8 shows theoretical maximum noise contours from AEDC testing.

The following sections assess the potential impacts associated with activities at AEDC. In general, the PWT plant supports Flight Operations, the VKF supports Space & Missile Operations, and the ETF plant supports Aeropropulsion Operations. However, these plants can be configured to augment other plants in order to increase the overall capability of the facilities. In order to evaluate the impacts of test assets at AEDC, the following sections will group test assets with the plant assets which house them or provide support. Utility assets and stand-alone test assets will be evaluated separately.

4.1.2 PWT Plant and Associated Test Assets

Potential environmental impacts from PWT operations are primarily associated with the 16T/16S main drive motors and compressors, PES drive motor and compressor, 16T/16S and PES air-to-water heat exchangers, and the PWT desiccant air drier.

Total electrical energy consumption for PWT averaged 86,300 MW-Hr/yr for CY 2000-2005, which is roughly equivalent to the energy required for approximately 6,000 residences. The normal peak load for the PWT facility is approximately 200 MW. Natural gas is used for the PWT air driers. The total average annual use of natural gas is approximately 7.3 MCF/yr. This amount represents only about 1% of the natural gas used for steam production at the AEDC.

4.1.2.1 Air Quality

Most tests in the PWT wind tunnels (16T, 16S, and 4T), other those that involving engine propulsion testing, produce no direct emissions to the atmosphere and therefore have no significant impact on the environment. Most emissions associated with PWT testing are related to the operation of support systems necessary to generate the wind velocity and other necessary testing conditions. Air emissions from PWT test assets and support facilities are summarized in Table 4-2. Air emissions from the PWT under the AEDC Title V permit consist of the air driers (Emissions Source #08) and the aeropropulsion engine testing (Emissions Source #52).

A natural gas combustion heater is used to regenerate the atmospheric air drier (Emission Source #08). The exhaust is vented to the atmosphere at the top of the drier building in accordance with the Title V permit conditions.

4.1.2.1.1 No Action Alternative

The data presented in Table 4-2 indicate that between CY 2000 and CY 2004 the PWT atmospheric drier emitted a maximum of approximately 1% of the AEDC total emissions of any NAAQS pollutant and a maximum of approximately 3.5% of the AEDC total emissions for any HAP. Operation of the heaters is limited by the operating hours and for this period has been approximately 33% of the maximum allowable emissions limit. There were no reported violations of NAAQS for criteria pollutants or HAPs from heater emissions for this period. Under the No Action Alternative, Emission Source #8 will not increase the operating hours.

PWT engine and rocket testing, which is controlled under the Title V permit under Emissions Source #52, reported no emissions for the period CY00 through CY04. Under the No Action Alternative, no turbine engine or liquid/solid rocket testing will be conducted in the PWT wind tunnels.

4.1.2.1.2 Proposed Alternative

The proposed action is to operate the PWT plant and test assets at maximum capability. The PWT atmospheric air driers (Emissions Source #08) are currently being operating at approximately 33% of the allowable limit based on data from CY 2000 through CY 2004. Accordingly, use of the PWT drier would increase by a factor of three under the proposed action.

Table 4-2. PWT Complex Air Emission Sources Range of Reported Emissions for Calendar Years 2000 -2004

Description	PWT Atm Air Dryer, Source #8			PWT Engine Testing, Source #52			AEDC Total (all sources)
	Minimum (tpy)	Maximum (tpy)	Percent of Base Total	Minimum (tpy)	Maximum (tpy)	Percent of Base Total	Maximum (tpy)
CO	0.00	1.21	0.71%	0.00	0.00	0.00%	170.03
NOx	0.00	1.44	1.17%	0.00	0.00	0.00%	122.89
PM	0.00	0.11	1.03%	0.00	0.00	0.00%	10.58
SOx	0.00	0.11	1.10%	0.00	0.00	0.00%	9.94
VOC	0.00	0.009	0.03%	0.00	0.00	0.00%	25.09
VOC HAP	0.00	0.027	0.34%	0.00	0.00	0.00%	8.03
CH4	0.00	0.033	0.28%	0.00	0.00	0.00%	11.83
CO2	0.00	1727.16	2.16%	0.00	0.00	0.00%	80077.98
NH3	0.00	0.046	2.98%	0.00	0.00	0.00%	1.54
N2O	0.00	0.032	1.62%	0.00	0.00	0.00%	1.95
Formaldehyde	0.00	0.001	0.03%	0.00	0.00	0.00%	3.59
Hexane	0.00	0.026	3.38%	0.00	0.00	0.00%	0.77
Naphthalene	0.00	0.000009	0.01%	0.00	0.00	0.00%	0.14
Toluene	0.00	0.000049	0.04%	0.00	0.00	0.00%	0.13
As	0.00	0.000003	0.01%	0.00	0.00	0.00%	0.03
Cd	0.00	0.000016	0.44%	0.00	0.00	0.00%	0.00
Co	0.00	0.000001	1.27%	0.00	0.00	0.00%	0.00
Cr	0.00	0.000020	0.06%	0.00	0.00	0.00%	0.03
Hg	0.00	0.000004	0.07%	0.00	0.00	0.00%	0.01
Mn	0.00	0.000005	0.64%	0.00	0.00	0.00%	0.00
Ni	0.00	0.000030	2.48%	0.00	0.00	0.00%	0.00
Pb	0.00	0.000007	0.02%	0.00	0.00	0.00%	0.04
POM	0.00	0.000001	0.03%	0.00	0.00	0.00%	0.00
Total HAPs	0.00	0.03	0.33%	0.00	0.00	0.00%	8.15

The majority of aerodynamic tests conducted at the PWT produces no direct emissions to the atmosphere and therefore have no significant impact on the environment. Certain types of aerodynamic testing have the potential for very limited emissions, such as aerodynamic studies with oil or paint and jet simulation which are considered insignificant.

Aeropropulsion testing in the PWT is regulated under the Title V permit. The exhausts consist almost entirely of nitrogen, oxygen, carbon dioxide, water vapor, and argon, which are naturally occurring atmospheric gases that are attenuated through natural processes. Particulates and sulfur dioxide are also emitted from PWT as the result of hydrocarbon fuel combustion. Under the proposed action, aeropropulsion testing would be limited to a fuel input rate not to exceed 80,000 lbs/hr and a maximum of 250 operating hours per year as defined in the Title V air permit. The wet scrubber control device will be used during all aeropropulsion testing which, in conjunction with the limited fuel input and maximum operating hours, will limit the particulate emissions to less than 3.8 lbs/hr, the total particulate output to 1 ton/year and the sulfur dioxide emissions to less than 1.4 tons/year.

Rocket testing at the PWT is also regulated under Emissions Source #52. Small liquid propellant rockets can be fired in the PWT with a maximum fuel input of 30,000 lbs/year and a maximum facility operating time of 250 hours per year. The wet scrubber control device will be active during all operating hours.

Solid propellant rockets can also be tested in the 16T and 16S test assets. In compliance with the Title V air permit, the fuel input rate for solid rockets will be limited to 30,300 lbs/year, the total operating time will not exceed 250 hours/year, and the wet scrubber device will be operated during all testing. These criteria will ensure that the hydrogen chloride concentration of the emissions will not exceed 3.22 tons/year and the particulate matter will not exceed 6.5 lb/sec or 1 ton/year.

These criteria and limits have been determined to not be significant by the TDEC for an air quality attainment area. Therefore, PWT plant and associated asset operations will not have a significant effect on the air quality at AEDC or surrounding areas.

4.1.2.2 Water Quality

The PWT plant utilizes non-contact cooling water to dissipate heat from operating equipment. Contact cooling water is required during aeropropulsion engine and solid/liquid rocket testing. Stormwater and industrial wastewater is collected and discharged through a storm drain system attached to the three AEDC discharge ditches.

4.1.2.2.1 No Action Alternative

The PWT has several heat exchangers that absorb thermal energy from the main compressors and other equipment through non-contact cooling water. Non-contact cooling water is also used in these exchangers to condition the process air in the tunnels and fuel temperature as required. Non-contact cooling water used to cool equipment, process air, and fuel, is discharged to the cooling water return system. This cooling water does not come into contact with the process air flow and the only change to the water is temperature. Cooling water discharged at AEDC is ultimately discharged to the retention reservoir or is pumped back to the ASTF cooling water return basin. The retention reservoir is managed as an industrial wastewater treatment facility. Accordingly, the change in non-contact water temperature associated with PWT operations has no effect on the environment.

Exhaust from turbine engine and rocket testing in the PWT wind tunnels requires use of contact quench water (wet scrubber control) in accordance with the Title V permit conditions. Since there has been no turbine engine or rocket engine testing in the past several years, the No Action Alternative does not include turbine engine or rocket testing as a potential test scenario.

Stormwater and other surface water drainage from PWT areas can become contaminated with oils and solvents. Similarly, floor drains in the various facilities have the potential for accumulating oils, solvents, and other contaminants associated with the test operations. Eight oil/water separators are strategically located in the PWT plant to collect and contain any floatable contaminants and collect sediments from floor drains and facility sumps. Water from floor drains and area stormwater enters the storm sewer system which discharges to Rowland, Bradley or Brumalow ditch. Bradley ditch utilizes a pump-back system which discharges to the retention reservoir where contaminants are contained and sediments are trapped before the water is discharged. Brumalow ditch utilizes two inverted siphon dams and a skimming dam to contain floating contaminants prior to being pumped to the cooling tower basin. Both Bradley and Brumalow ditch systems also have skimming ponds for final control of floating contaminants and sediments. Rowland ditch flows through the retention reservoir which incorporates sediment curtains, skimming booms, and skimming lagoons for sediment control and floating contaminant collection. A pump-back system is in place to route a portion of the water back into the cooling water collection system.

The retention reservoir includes adsorbent booms and a turbidity curtain to minimize contaminants in the water supply. In the event that a heat exchanger failed and the non-contact cooling water became contaminated with lubricating oils or other contaminants, these controls would mitigate any impacts. The NPDES permit requirements established criteria to ensure that water is not significantly impacted by AEDC test assets. Any cooling water discharged to Woods Reservoir via Rowland Creek passes Outfall 001, which is regularly sampled to ensure that the NPDES criteria are met. Records of recent AEDC operations for the period CY 2000 through 2005 indicate that only occasional permit excursions occur and are limited to pH excursions and a single violation of the lead criterion in 2001. The trend over time reflects that less permit excursions have resulted recently.

4.1.2.2.2 Proposed Alternative

Aerodynamic testing in the PWT plant is limited only by the hours of operation of the atmospheric air dryer. Based on previous years of operation, aerodynamic testing could increase by a factor of three which would translate to a potential tripling of the amount of non-contact cooling water required. Since the only change to the cooling water is a rise in temperature and the retention reservoir provides adequate area and time for the water to equilibrate to ambient conditions, there should be no additional impact from an increase in test frequency or duration.

Exhaust from turbine engine and rocket testing in the PWT wind tunnels requires use of contact quench water (wet scrubber control) in accordance with the Title V permit conditions. Exhaust gases are vented to the ETF A/B Plant exhaust system, which has a quench water system. Accordingly, the assessment of impacts associated with the engine test exhaust is addressed in the ETF Plant section (Section 4.1.4.2, Water Quality).

Increased test hours under the Proposed Alternative would have no affect on the stormwater and wastewater system. The eight oil/water separators are sufficient to handle any additional spills or leaks of petroleum products that may occur from increased operation of plant equipment.

Based on the existing infrastructure and management systems for cooling water, building drainage, stormwater discharge, and compliance with the NPDES permit criteria, no significant impacts are anticipated to water resources from PWT plant operations.

4.1.2.3 Hazardous Materials and Waste

PWT plant has five hazardous waste streams associated with operation and maintenance of the facilities with only four of the waste streams having reoccurring wastes. The active waste streams are: WS# 54 – 111-TCA, WS# 101 – Solvent/Oil, WS# 108 – Used Oil Sludge, and WS# 152 – Sodium Hydroxide (Appendix J). WS# 108 is the only waste stream with annual production having a maximum of 8755 kg of waste in CY04.

Hazardous materials are dispensed through the HAZMAT pharmacy (Figure 3-9) and tracked from distribution through disposal. Hazardous Materials storage cabinets are located at various locations within the PWT plant for storage of materials when not in use. Hazardous material turn-in points are available to return unused hazardous materials.

4.1.2.3.1 No Action Alternative

Under the No Action Alternative, use of hazardous materials and generation of hazardous waste should continue as in past years. All waste streams with the exception of WS# 108 should be infrequent and in relatively small quantities.

Hazardous material usage should remain the same. The ordering and dispensing program at AEDC will minimize collection of excess materials and the ordering of extremely hazardous materials unless absolutely necessary.

4.1.2.3.2 Proposed Alternative

Increase testing hours will potentially increase the amount of hazardous materials required and the hazardous waste generated. Increased frequency of test asset cleaning will increase the frequency and amount of WS# 54 and/or WS# 101. Used oil sludge from WS# 108 will also increase as the sludge from sumps and oil/water separators is generated. However, it is doubtful that the increase will be at the same rate as the testing durations.

Purchase of hazardous materials, specifically jet fuel, will increase with the resumption of aeropropulsion testing in the 16T and 16S test assets. A potential maximum of 2.6 million gallons of jet fuel would have to purchased if the test assets were used with the maximum fuel flow and maximum hours of operation. This fuel would be stored at the bulk fuel farm and dispensed as needed.

Since AEDC has adequate procedures in place to handle the fuels and hazardous wastes, no significant impact to the environment is expected from the increased activities.

4.1.2.4 Occupational Health and Safety

Noise from the PWT is primarily from 16T and the associated equipment. While the source noise measurements range up to 118 dBA, sound attenuation reduces the noise levels to less than 73 dBA at the nearest AEDC gates (Main Gate, Gates 1 and 2).

4.1.2.4.1 No Action Alternative

The noise levels for the PWT plant have been studied extensively by the AEDC Industrial Hygiene department. Areas are posted with appropriate warnings and worker safety programs include hearing protection in compliance with OSHA. Current noise levels are consistent with those measured in previous assessments and the criteria for noise significance thresholds are the same, so no significant impact to the environment from noise is anticipated from baseline PWT operations. (AEDC 1977).

4.1.2.4.2 Proposed Action

An increase in plant and test assets by a factor of three would not increase the maximum sound levels but would increase the duration of the increased noise levels. Policies and procedures currently in place at AEDC would insure that all workers are protected from the elevated noise levels. Continued monitoring by the AEDC Industrial Hygiene department would ensure continued worker safety and health.

4.1.3 VKF Plant and Associated Test Assets

The primary environmental effects of VKF plant operations are associated with support systems such as air compressors required for creating for testing conditions. Generally, no harmful emissions are associated with the test articles or the units. The test assets supported primarily by the VKF plant include wind tunnels A, B, and C; as well as the APTU and HEAT test assets.

Total electrical energy consumption for VKF averaged approximately 6,000 MW-Hr/yr for CY 2000 through 2005, which is roughly equivalent to the energy required for 425 residences. Average electrical demand at the VKF during operations is approximately 40 MW with peak loading of approximately 63 MW. This average power usage at VKF is approximately 7% of the power consumed by the PWT plant and less than 6% of that used by the ETF plant.

Natural gas is used for the VKF air driers. The total average annual use of natural gas is approximately 2.4 MCF/yr, which is less than 1% of the natural gas used for steam production at AEDC. The VKF plant natural gas consumption is approximately 10% of that required at the ETF plant and approximately 33% of that required at the PWT plant.

The nature and characteristics of several small laboratory-scale test units within the VKF have limited potential for environmental consequences. These types of laboratory-based units would generally qualify for a categorical exclusion (CATEX) under the Air Force EIAP regulations [32 CFR 989.13 and 32 CFR 989.40 (App. B including the CATEX list)]. Specifically, CATEX A2.3.27 applies, which includes "[n]ormal or routine basic and applied scientific research confined to the laboratory and in compliance with all applicable safety, environmental, and natural resource conservation laws." While this CATEX could apply to these laboratory test units, other circumstances potentially causing significant environmental impacts can require additional analysis (32 CFR 989.40, App. B). The characteristics of these test units present limited opportunity for environmental consequences because they have limited air emissions, do not contact the land or water, and fail to generate discernible noise outside of the laboratory. Some of these research test cells use cryogenic gases such as nitrogen and helium and outgas testing materials, but incidental releases to the laboratory and the atmosphere are minimal and attenuated through ventilation and natural processes. Nitrogen and helium are asphyxiants, but personnel safety is provided through adherence to the safety program and oxygen-monitoring systems are used to ensure worker safety. The electrical demand for these test units is not discernible compared with the overall AEDC usage. No significant impacts are anticipated from operation of these research units.

4.1.3.1 Air Quality

The combustion products discharged to the atmosphere from the natural gas-fired heater (HB1A and HB1B) and the four natural gas-fired air driers (W-15 through W-18) are the most significant air emissions from the VKF. Presently, compliance with the conditions established in the Title V permit protects the air resources in accordance with the Clean Air Act Amendments

4.1.3.1.1 No Action Alternative

Air emissions from the VKF plant and associated assets are regulated under the AEDC Title V permit and include the VKF heaters (Source #7), the APTU Test Facility (Source #14), the HB1A and HB1B heaters (Source #28), the VKF auxiliary heater (Source #35), and the arc heaters H1, H2, and H3 (Source #42). Table 4-3 shows emissions data for these sources which is discussed in the following paragraphs.

Table 4-3. VKF Complex Emission Sources Range of Reported Emissions for Calendar Years 2000 - 2004

Description	VKF Heaters, #7			APTU, #14			HB1 Heaters, #28		
	Min (tpy)	Max (tpy)	Percent of AEDC Total	Min (tpy)	Max (tpy)	Percent of AEDC Total	Min (tpy)	Max (tpy)	Percent of AEDC Total
CO	0.008	10.83	6.37%	0.00	100.41	59.05%	0.00	9.64	5.67%
NOx	0.009	14.46	11.76%	0.00	0.054	0.04%	0.00	24.92	20.28%
PM	0.001	0.98	9.26%	0.00	0.000	0.00%	0.00	1.15	10.84%
SOx	0.000	0.077	0.78%	0.00	0.000	0.00%	0.00	0.065	0.65%
VOC	0.001	0.71	2.83%	0.00	0.002	0.01%	0.00	0.71	2.83%
VOC HAP	0.00	0.002	0.02%	0.00	0.000	0.00%	0.00	0.15	1.90%
TSP HAP	0.00	0.23	93.06%	0.00	0.000	0.00%	0.00	0.000	0.20%
CH_4	0.000	0.30	2.51%	0.00	10.50	88.75%	0.00	0.36	3.07%
CO_2	11.28	15473.76	19.32%	0.00	48.60	0.06%	0.00	20785.57	25.96%
NH_3	0.000	0.41	26.71%	0.00	0.00	0.00%	0.00	0.26	16.78%
N_2O	0.000	0.28	14.54%	0.00	0.00	0.00%	0.00	0.97	49.97%
Benzene	0.000	0.000271	0.06%	0.00	0.000	0.00%	0.00	0.000	0.04%
Formaldehyde	0.00	0.002	0.04%	0.00	0.000131	0.00%	0.00	0.006	0.17%
Hexane	0.000003	0.23	30.32%	0.00	0.00	0.00%	0.00	0.15	19.04%
Naphthalene	0.00	0.00	0.00%	0.00	0.000005	0.00%	0.00	0.000	0.04%
Toluene	0.000	0.000438	0.34%	0.00	0.000005	0.00%	0.00	0.000275	0.21%
1,1,1 TCA	0.000	0.000026	11.54%	0.00	0.00	0.00%	0.00	0.00	0.00%
As	0.000	0.000026	0.08%	0.00	0.00	0.00%	0.00	0.000016	0.05%
Cd	0.000	0.000142	3.94%	0.00	0.00	0.00%	0.00	0.000089	2.48%
Co	0.000	0.000011	11.34%	0.00	0.00	0.00%	0.00	0.000007	7.13%
Cr	0.000	0.000181	0.53%	0.00	0.00	0.00%	0.00	0.000113	0.33%
Hg	0.000	0.000034	0.59%	0.00	0.00	0.00%	0.00	0.000021	0.37%
Mn	0.000	0.000049	5.70%	0.00	0.00	0.00%	0.00	0.000031	3.58%
Ni	0.000	0.000271	22.23%	0.00	0.00	0.00%	0.00	0.000170	13.96%
Pb	0.000	0.000064	0.18%	0.00	0.00	0.00%	0.00	0.000041	0.11%
POM	0.000	0.000007	0.24%	0.00	0.00	0.00%	0.00	0.000004	0.15%
Total HAPs	0.00	0.23	2.87%	0.00	0.000253	0.00%	0.00	0.153	1.88%
CO	0.00	5.89	3.46%	0.00	0.00	0.00%	126.76	74.55%	170.03
NOx	0.00	19.62	15.97%	0.00	0.41	0.33%	59.00	48.01%	122.89
PM	0.00	0.53	5.03%	0.00	0.00	0.00%	2.66	25.13%	10.58%
SOx	0.00	0.042	0.42%	0.00	0.00	0.00%	0.18	1.85%	9.94%
VOC	0.00	0.39	1.54%	0.00	0.00	0.00%	1.81	7.20%	25.09%
VOC HAP	0.00	0.13	1.64%	0.00	0.00	0.00%	0.28	3.54%	8.03%
TSP HAP	0.00	0.000	0.17%	0.00	0.00	0.00%	0.23	93.43%	0.25%
CH_4	0.00	0.16	1.36%	0.00	0.00	0.00%	11.32	95.69%	11.83%
CO_2	0.00	8409.60	10.50%	0.00	0.00	0.00%	44668.93	55.78%	80077.98%
NH_3	0.00	0.22	14.52%	0.00	0.00	0.00%	0.90	58.01%	1.54%
N_2O	0.00	0.15	7.90%	0.00	0.00	0.00%	1.41	72.42%	1.95%
Benzene	0.00	0.22	48.16%	0.00	0.00	0.00%	0.22	48.26%	0.47%
Formaldehyde	0.00	0.15	4.30%	0.00	0.00	0.00%	0.16	4.47%	3.59%
Hexane	0.00	0.002	0.24%	0.00	0.00	0.00%	0.38	49.36%	0.77%
Naphthalene	0.00	0.00	0.00%	0.00	0.00	0.00%	0.00	0.04%	0.14%
Toluene	0.00	0.00	0.00%	0.00	0.00	0.00%	0.00	0.56%	0.13%
1,1,1 TCA	0.00	0.00	0.00%	0.00	0.00	0.00%	0.00	11.54%	0.00%
As	0.00	0.00	0.00%	0.00	0.00	0.00%	0.00	0.12%	0.03%
Cd	0.00	0.000001	0.03%	0.00	0.00	0.00%	0.00	6.42%	0.00%
Co	0.00	0.00	0.09%	0.00	0.00	0.00%	0.00	18.47%	0.00%
Cr	0.00	0.000001	0.00%	0.00	0.00	0.00%	0.00	0.86%	0.03%
Hg	0.00	0.005256	91.97%	0.00	0.00	0.00%	0.01	92.92%	0.01%
Mn	0.00	0.00	0.04%	0.00	0.00	0.00%	0.00	9.28%	0.00%
Ni	0.00	0.000002	0.17%	0.00	0.00	0.00%	0.00	36.19%	0.00%
Pb	0.00	0.000001	0.00%	0.00	0.00	0.00%	0.00	0.30%	0.04%
POM	0.00	0.00	0.00%	0.00	0.00	0.00%	0.00	0.39%	0.00%
Total HAPs	0.00	0.38	4.71%	0.00	0.00	0.00%	0.77	9.45%	8.15%

Data for CY 2000 through 2004 indicate that the VKF heaters emitted up to 10% of the total emissions from the AEDC based on the maximum annual emissions. The total maximum annual HAPs emissions were 0.23 tpy which is less than 3% of the total for the AEDC. The dryer reactivation heaters operated at 36% of the maximum operating capacity during this period. The dryers are limited to 1,920 hours per year by the Title V permit.

The HB1A and HB1B heaters emitted up to approximately 20% of the total emissions from the AEDC based on the maximum annual emissions. The total maximum annual HAPs emissions were 0.15 tpy which is less than 2% of the total for the AEDC.

The Arc Heaters H1, H2, and H3 emitted 0.41 tpy of NOx with no emissions of other NAAQS criteria pollutants or HAPs. Arc Heaters H1 and H3 discharge directly to the atmosphere while H3 exhausts through the PWT/PES or the ETF plants. The Arc Heaters operated at slightly over 4% of the maximum allowable capacity based on the Title V air permit.

The APTU emits primarily CO and methane with only comparatively minor amounts of NOx, VOCs and HAPs. The maximum annual emission rate of CO from the APTU was approximately 100 tpy during the period CY2000 to CY2004 which is almost 60% of the maximum annual total CO emitted from AEDC. The maximum annual emission rate of methane is approximately 10.5 tpy which was almost 90% of the maximum emissions from AEDC. Other emissions account for less than 0.06% of the total from the AEDC. APTU is limited in the Title V air permit by operating hours and has historically used only 0.2% of the maximum capacity.

The majority of flight operations conducted in the VKF wind tunnels produce no direct emissions to the test unit atmosphere and therefore have insignificant impact on the environment. Certain types of testing in the VKF wind tunnels have the potential for limited emissions, such as aerodynamic studies using oil or paint, jet simulation, boundary layer studies, and heat transfer tests. Representative potential impacts from jet simulation and oil/paint studies are addressed for the PWT (Section 4.1.2.1.2).

Boundary layer studies can be conducted in the wind tunnels of the VKF using various gases including argon, ammonia, helium, carbon dioxide, refrigerants, and sulfur hexafluoride. The gas is continuously supplied through machined holes or pores in the model to allow the gas to form a thin film or layer over the surface of the model, which then becomes entrained in the tunnel air stream and discharged to the atmosphere. The flow rates are on the order of 0.01 lb/sec and mix with the tunnel air before discharge. The concentrations of the gases at the stack outlet are below worker safety criteria, and diffusion further attenuates the concentrations reaching ground level. The potential annual emissions are relatively small and the impact on air quality is considered insignificant.

A low-pressure, low-temperature nitrogen supply system introduces nitrogen onto a thin-walled model in the VKF wind tunnels to perform heat transfer tests. The nitrogen then is entrained in the tunnel air stream and mixes with the air before exhausting through stacks approximately 20 feet above ground level in the compressor ducting yard of the VKF Main Compressor Plant. Nitrogen is also used in the VKF wind tunnels for cooling the air stream. This has an insignificant impact on the air quality as nitrogen comprises the majority of atmospheric air and the volume used is small and mixes with the tunnel air flow before being discharged.

High pressure air provided by the VKF plant is heated in the HEAT test assets at high pressures by electric arc heaters. HEAT test assets H1 and H3 exhaust to this air to the atmosphere about 12 feet above the ground after flowing through the test unit while test asset H2 utilizes the PWT or the ETF plants for exhaust support and discharges about 60 feet above the ground. The air entering the arc heater is clean, high pressure air and is only changed by the arc heating process. The composition of the air exiting the arc heaters consists of over 93% nitrogen (N_2), atomic nitrogen (N), oxygen (O_2), and atomic oxygen (O). Approximately 5% is nitric oxide (NO) and the remaining composition is ozone, argon, and trace amounts of carbon monoxide, carbon dioxide, and nitrogen dioxide (NO_2). These gases are mixed with air prior to release to the atmosphere. The only emissions of potential concern are the nitric oxide (5.26%), atomic nitrogen (1.87%), atomic oxygen (27.8%), and ozone (0.4%). Atomic nitrogen and atomic oxygen are unstable at ambient temperatures and form molecular nitrogen and oxygen almost immediately while still in the exhaust stack. While nitric oxide can persist for hours, the test run durations are usually less than 2 minutes and will result in an insignificant amount of nitric oxide discharged to the environment.

Materials used in ablation tests performed in the HEAT units are normally carbon or its composites. The material is sheared away in solid form or as a dust, generally in quantities less than an ounce, and entrained in the exhaust gas discharged to the atmosphere. Because of the limited quantities discharged, the environmental impact is considered insignificant. The primary source of ablation test emissions is from the operation of the arc heaters rather than the materials being tested.

Ablation and erosion tests performed in Tunnels B and C of the VKF release small quantities of gases from the test material due to oxidation and pyrolysis. Gases generated primarily consist of carbon monoxide, cyclic hydrocarbons (e.g. benzene and toluene), and possibly hydrogen cyanide although laboratory bench testing failed to generate detectable concentrations of this compound. These gases are mixed with the tunnel air flow before being exhausted to the atmosphere approximately 20 feet above the ground surface in the ducting yard area of the VKF Main Compressor Plant. The environmental impact is considered insignificant due to the volume of gases exhausted and the short duration of the tests.

A beryllium-copper alloy is used as a basic structural material for ablation and erosion models in Range G. Beryllium has been detected near the model impact area immediately following test shots. Sampling results estimate that approximately one-third of the beryllium remains as solid or liquid in the test unit, but the remainder is discharged to the atmosphere during the ventilation process. The ventilation process dilutes the beryllium discharge but measurable concentrations have been recorded at the start of the exhaust process. These concentrations were found to dissipate within 10 to 15 minutes. The discharge of beryllium-contaminated air creates short duration hazards in the immediate vicinity of the exhaust stacks requiring safety zones for personnel protection. The beryllium air emissions are considered to be an insignificant impact.

Oil is emitted to the atmosphere from the vacuum pump systems at the VKF plant and the Gun Range Complex, but oil separator units on the stacks are used to remove virtually all of the oil from the air to prevent any significant impact (AEDC 1977).

Small quantities of gun powder gases, including carbon monoxide, carbon dioxide, water vapor, and nitrogen, as well as helium and hydrogen are discharged after tests to the atmosphere from vent stacks on the launcher system blast tanks on Ranges G and S1. The discharge point is 20 to 30 feet above ground level outside of the enclosed range area, so no significant environmental effect is present.

Air is used as the test gas in most gun range tests, but special test gases such as nitrogen, argon, or helium are sometimes used in Range G. The volume of gas used varies depending on the testing requirements, but the maximum volume is approximately 60,000 scf in Range G. Nitrogen, argon, and helium are not toxic gases, but they act as asphyxiants by displacing oxygen in the air. Oxygen-monitoring systems are used to ensure worker safety in critical operating areas and to monitor areas before personnel are allowed entry. Venting of the range tank upon test completion allows mixing of the gas with air for dilution and discharge to the atmosphere 15 feet above ground level. No significant environmental impact is expected from the gases used during the Range G tests.

Mercury, xenon, and krypton have been used in Range G for wake diagnostic studies of test models. Upon completion of the test, the gas in the tank is vented with air and exhausted to the atmosphere 15 feet above ground level. Small quantities of mercury have been used and but no environmental impact is anticipated based on the small quantities and attenuation when mixed with air. Krypton and xenon are essentially inert and non-toxic, but can act as an asphyxiant. However, no environmental impacts are associated because of the small volumes used, the mixing with air prior to discharge, and the oxygen monitoring systems used to protect workers.

The overall impacts on air quality from operation of the VKF plant and associated test assets are considered insignificant based on the limits set by the Title V air permit.

4.1.3.1.2 Proposed Alternative

The VKF was permitted for air emissions prior to the development of the PSD threshold criteria and was grandfathered into the Title V permit. This was in part due to the fact that all the VKF plant sources are limited by operating time such that the emissions will be below PSD thresholds.

The VKF drier activation heaters (Source #07) is permitted to operate for 1,920 hours/year which is nearly 3 times the maximum amount operated during the CY2000 to CY2004 time frame. The process heater which is included in the same source is permitted for 1200 hours/year and has not been used during the review period. The Title V air permit has no emission limits for this source other than maximum operating hours.

HB1A and HB1B heaters are natural gas fired and are permitted for operation up to 3,000 hours/year. The maximum annual hours of operation during the review period was approximately 614 hours. Under the proposed action, these heaters would be utilized up to 4.8 times the previous maximum use. The Title V air permit has no emission limits for this source other than maximum operating hours.

The three HEAT test assets are permitted to operate up to 27 hours per year. Since the test durations are very short, the maximum annual operating time has been 1.12 hours. This allows an approximately 25 fold increase in activity while still remaining complaint with the Title V permit. Assuming the HEAT test assets would be operated in a similar manner as during the review period, this would result in NOx emissions of 9.86 tons/year which is less than half the allowable emissions of 20.4 tons/year.

Ranges G and S1 would have similar emissions as the No Action Alternative. Since the emitted gases are either inert or of extremely low concentrations, no significant environmental impact is anticipated.

Since AEDC is in an air quality attainment area, the maximum emissions from the VKF plant as associated test assets are not expected to have a significant effect on the area air quality

4.1.3.2 Water Quality

The major use of water in the VKF plant and associated test assets is for non-contact cooling of facility systems. APTU also uses raw water for exhaust gas scrubbing. Stormwater is discharged to either Rowland or Bradley ditches, with the predominate flow going to Rowland ditch.

4.1.3.2.1 No Action Alternative

Cooling water is used in the main compressor systems, vacuum pumps, and refrigeration systems within the VKF. Non-contact cooling water is processed through heat exchangers in the main compressor systems and maintained at a pressure greater than the oil pressure so that any breach in the system would cause water to leak into the oil instead of oil contaminating the cooling water. No environmental impact associated with the cooling water is expected since the only expected change to the water is temperature. Circulation of the water through the retention reservoir should provide enough retention time to allow the water to equilibrate to ambient conditions.

Approximately 60% of the quench water used for exhaust gas scrubbing at the APTU does not evaporate and falls to the ground surrounding the test unit. This runoff drains to the retention reservoir. No significant impact has been associated with sediment carried in the surface water runoff or the turbidity of the runoff (AEDC 1977). In 1996, a turbidity curtain was installed in the retention reservoir to ensure that influent water has adequate residency time for solids to settle out before the water is either recycled to the raw cooling water supply system or discharged to a tributary to Rowland Creek. No significant impact to the surface water is anticipated from the runoff of the APTU quench water.

Stormwater and other surface water drainage from VKF plant yard areas such as the compressor yard area, plant, and shop areas can become contaminated with oils and solvents and are discharged through Bradley and Rowland ditches. Any drainage from the HEAT test asset facility would discharge to Brumalow ditch. VKF maintains one oil/water separator in the yard area to intercept and collect and petroleum products that might be spilled or collected by the stormwater. No significant environmental effects are anticipated under current conditions.

4.1.3.2.2 Proposed Action

The volume of cooling water is expected to increase with the increased operating time of the VKF plant and associated test assets. Since there are no contaminants during the non-contact process, no significant impact is expected to the environment.

An increase in APTU quench water will result in significantly more water being discharged to the ground surrounding APTU and flowing to the retention reservoir. The addition of a turbidity curtain to the retention reservoir and implementation of best management practices to minimize soil erosion should minimize the amount of sediment transported to the retention reservoir and Rowland Creek.

With the engineering control measures in place, there should be no significant impact to the surrounding aquatic environment.

4.1.3.3 Hazardous Materials and Waste

4.1.3.3.1 No Action Alternative

There are eight reoccurring waste streams associated with the VKF plant (Appendix J). During the period CY2000 through CY2005, WS# 175 – “Test Facility Wash Water” was the only waste stream to generate hazardous waste with a maximum of 5,000 kg in CY2001 and no waste in CY2002 and CY005. Under the no action alternative, this trend of inconsistent and varying generation of hazardous waste is expected.

Hazardous materials are dispensed through the HAZMAT pharmacy (Figure 3-9) and tracked from distribution through disposal. Hazardous Materials storage cabinets are located at various locations within the

VKF plant for storage of materials when not in use. Hazardous material turn-in points are available to return unused hazardous materials.

Hazardous material usage should remain the same. The ordering and dispensing program at AEDC will minimize collection of excess materials and the ordering of extremely hazardous materials unless absolutely necessary.

4.1.3.3.2 Proposed Action

Based on Title V air permit limits, operation of the VKF plant dryer reactivation heaters will only allow the test assets to operate at three times the historic average. Therefore, it would be expected for the hazardous waste from WS# 175 to increase at no more than a factor of three. AEDC utilizes a contract with DRMO to transport and dispose of all base hazardous waste. The potential increase in hazardous waste will no pose a significant impact on the environment as long as it is collected, stored and disposed according to environmental regulations.

Turbine engine testing at APTU would result in more hazardous materials (i.e. jet fuel) purchases. Based on the maximum operating time and the fuel consumption limit of the Title V air permit, approximately 716,000 gallons of jet fuel would be required each year to fully utilize the facility. This fuel would be stored at the bulk fuel farm and dispensed as needed.

Since AEDC has adequate procedures in place to handle the fuels and hazardous wastes, no significant impact to the environment is expected from the increased activities.

4.1.3.4 Occupational Health and Safety

4.1.3.4.1 No Action Alternative

Noise from AEDC operations creates the greatest occupational health risk for employees, contractors and visitors. The greatest potential for noise in the VKF complex is associated with ramjet testing in the APTU. The maximum measured noise levels are 119 dBA, with a maximum estimated value of 169 dBA. Noise levels in the compressor building and the Aerospace Environmental Chamber Complex can range up to 109 dBA for short periods (less than 30 minutes during an 8 hour shift). Noise in the Gun Range Complex can be as high as 99 dBA. The HEAT arc heaters work at higher output levels to achieve the chamber pressure required for ablation tests resulting in greater noise levels. Levels next to the nozzle exit are approximately 130 dBA; however, the duration of the test is brief and infrequent.

Areas are posted with warnings and worker safety programs include hearing protection in compliance with OSHA. Noise effects outside of the plant equipment areas are insignificant. Based on industrial hygiene surveys and the hearing protection procedures in place, there should be no significant impact due to noise levels

4.1.3.4.2 Proposed Action

Increased testing will result in increased duration of elevated noise levels but will not increase the maximum measured values. Industrial hygiene will continue monitoring levels to ensure that workers are not subject to levels which exceed the OSHA requirements for dBA levels or duration.

4.1.4 ETF Plant and Associated Test Assets

The primary emissions from the ETF plant are from engine combustion, equipment cooling, and conditioning of air (drying, refrigeration, and heating) for operation of test assets.

The total average electrical energy consumption for ETF for CY 2000 through 20005 was approximately 106,000 MW-Hr/yr, which is roughly equivalent to the energy required for 7,400 residences (Table 4-1). This is approximately 1.25 times as much power consumed by the PWT and almost 18 times as much power used by VKF on an average annual basis.

Natural gas is used for the heaters and air driers. The total average annual use of natural gas is approximately 20.2 MCF/yr at the ETF, which is approximately 3.5% of the natural gas used for steam production at the AEDC (some of which supports test assets at the ETF). The ETF natural gas consumption is almost three times as much as that required at the PWT and over eight times that required for VKF.

The ETF Research Test Cells perform the same general types of tests as the respective full-size engine test facilities, but are substantially smaller to provide needed research data to develop the later mock-ups. Consequently, the potential environmental impacts are similar to those discussed for the ETF test cells, but on a much smaller scale. As with the VKF Laboratory Aerospace Chambers, these small research test cells likely qualify for a CATEX under the Air Force EIAP regulations [32 CFR 989.13 and 32 CFR 989.40 (App. B, CATEX A2.3.27)]. Regardless of the applicability of a CatEx, the smaller-scale ETF research cells would have no potential for significant impact where the comparable larger test cells are found to have insignificant impact.

4.1.4.1 Air Quality

Air emission sources from the ETF include air heaters (emissions source #06), the ASTF [air heaters (#30), air strippers (#45), and engine test emissions (#31)], Steam Plant C (#43), the T-3 air heater (#45), the SL-1 test cell (#53), SL-2 and SL-3 test cells (#56), the liquid and solid rocket tests units (#17 and #18, respectively), and the Westinghouse Combustor (#54). Each air emissions source in the ETF is operated in strict accordance with the AEDC Title V major source air quality control operating permit.

4.1.4.1.1 No Action Alternative

Air emission data for CY 2000 through CY 2004 indicate that the natural gas heaters (Emissions Source #06) emitted an annual maximum of 1.77 tpy of CO, 5.89 tpy of NOx, 0.16 tpy particulate matter, 0.013 tpy SOx, and 0.12 tpy VOCs (Table 4-4). Maximum total HAPs emissions were 0.04 tpy. These heaters contribute less than 5% of the total emissions at the AEDC for any NAAQS pollutant or HAPs. Operation of the heaters meets the Title V air quality operating permit conditions and could be operated at their capacity while still remaining within the permit conditions. No reports of violation of NAAQS for criteria pollutants or HAPs from heater emissions were filed during this period.

The ETF aeropropulsion test assets, including the glycol reboilers and the wet scrubbers and vapor condensers for aircraft engine emissions (Emissions Source #19) accounted for up to 8.5% of the total maximum annual emissions for the NAAQS pollutants and total HAPs from AEDC. The ETF test cells contribute a maximum of almost 40% of the total emissions of ethylene glycol from AEDC. These emissions were within the Title V permit conditions with no reports of NAAQS violation. The limiting operational factor for Emissions Source #19 is the annual operating time, which is a total of 3,600 hours per year in combination with the ASTF (ETF C-Plant) aeropropulsion test assets (Emissions Source #31).

Table 4-4. ETF Complex Air Emission Sources Range of Reported Emissions for Calendar Years 2000-2004

ETF Complex Air Emission Sources Range of Reported Emissions for Calendar Years 2000-2004						
Description	ETF Cont. Air Heaters, #6			Liquid Rocket ETF, #17		
	Minimum (tpy)	Maximum (tpy)	Percent of AEDC Total (tpy)	Minimum (tpy)	Maximum (tpy)	Percent of AEDC Total (tpy)
CO	0.00	1.77	1.04%	0.00	0.00	0.00%
NOx	0.00	5.89	4.79%	0.00	0.00	0.00%
PM	0.00	0.16	1.51%	0.00	0.00	0.00%
SOx	0.00	0.013	0.13%	0.00	0.00	0.00%
VOC	0.00	0.12	0.46%	0.00	0.00	0.00%
VOC HAP	0.00	0.04	0.49%	0.00	0.00	0.00%
TSP HAP	0.00	0.000	0.05%	0.00	0.00	0.00%
CH4	0.00	0.048	0.41%	0.00	0.00	0.00%
CO2	0.00	2525.22	3.15%	0.00	0.00	0.00%
NH3	0.00	0.067	4.36%	0.00	0.00	0.00%
N2O	0.00	0.046	2.37%	0.00	0.00	0.00%
Acetaldehyde	0.00	0.00	0.00%	0.00	0.00	0.00%
Acrolein	0.00	0.00	0.00%	0.00	0.00	0.00%
Benzene	0.00	0.000044	0.01%	0.00	0.00	0.00%
1,3-Butadiene	0.00	0.00	0.00%	0.00	0.00	0.00%
2-Butanone	0.00	0.00	0.00%	0.00	0.00	0.00%
Chloroform	0.00	0.00	0.00%	0.00	0.00	0.00%
1,1-Dichloroethene	0.00	0.00	0.00%	0.00	0.00	0.00%
Ethylbenzene	0.00	0.00	0.00%	0.00	0.00	0.00%
Ethylene Glycol	0.00	0.00	0.00%	0.00	0.00	0.00%
Formaldehyde	0.00	0.002	0.04%	0.00	0.00	0.00%
Hexane	0.00	0.038	4.95%	0.00	0.00	0.00%
Methylene Chloride	0.00	0.00	0.00%	0.00	0.00	0.00%
Naphthalene	0.00	0.000013	0.01%	0.00	0.00	0.00%
Phenol	0.00	0.00	0.00%	0.00	0.00	0.00%
Propionaldehyde	0.00	0.00	0.00%	0.00	0.00	0.00%
Styrene	0.00	0.00	0.00%	0.00	0.00	0.00%
Toluene	0.00	0.000072	0.06%	0.00	0.00	0.00%
1,1,1 Trichloroethane	0.00	0.00	0.00%	0.00	0.00	0.00%
Trichloroethylene	0.00	0.00	0.00%	0.00	0.00	0.00%
Vinyl Chloride	0.00	0.00	0.00%	0.00	0.00	0.00%
o-Xylene	0.00	0.00	0.00%	0.00	0.00	0.00%
As	0.00	0.000004	0.01%	0.00	0.00	0.00%
Be	0.00	0.00	0.00%	0.00	0.00	0.00%
Cd	0.00	0.000023	0.64%	0.00	0.00	0.00%
Co	0.00	0.000002	1.85%	0.00	0.00	0.00%
Cr	0.00	0.000029	0.09%	0.00	0.00	0.00%
Hg	0.00	0.000005	0.10%	0.00	0.00	0.00%
Mn	0.00	0.000008	0.93%	0.00	0.00	0.00%
Ni	0.00	0.000044	3.63%	0.00	0.00	0.00%
Pb	0.00	0.000011	0.03%	0.00	0.00	0.00%
POM	0.00	0.000001	0.04%	0.00	0.00	0.00%
Se	0.00	0.00	0.00%	0.00	0.00	0.00%
Total HAPs	0.00	0.04	0.49%	0.00	0.00	0.00%

ETF Complex Air Emission Sources Range of Reported Emissions for Calendar Years 2000-2004						
Description	Solid Rocket ETF, #18			Engine Test Facility, #19		
	Minimum (tpy)	Maximum (tpy)	Percent of AEDC Total (tpy)	Minimum (tpy)	Maximum (tpy)	Percent of AEDC Total (tpy)
CO	0.00	7.22	4.25%	0.00	5.61	3.30%
NOx	0.00	0.00	0.00%	0.00	10.48	8.53%
PM	0.00	0.00	0.00%	0.00	0.064	0.61%
SOx	0.00	0.00	0.00%	0.00	0.84	8.43%
VOC	0.00	0.00	0.00%	0.00	0.45	1.80%
VOC HAP	0.00	0.00	0.00%	0.00	0.29	3.60%
TSP HAP	0.00	0.00	0.00%	0.00	0.001	0.44%
CH4	0.00	0.00	0.00%	0.00	0.00	0.00%
CO2	0.00	0.00	0.00%	0.00	0.00	0.00%
NH3	0.00	0.00	0.00%	0.00	0.00	0.00%
N2O	0.00	0.00	0.00%	0.00	0.00	0.00%
Acetaldehyde	0.00	0.00	0.00%	0.00	0.022	1.96%
Acrolein	0.00	0.00	0.00%	0.00	0.011	1.96%
Benzene	0.00	0.00	0.00%	0.00	0.009	1.95%
1,3-Butadiene	0.00	0.00	0.00%	0.00	0.009	1.96%
2-Butanone	0.00	0.00	0.00%	0.00	0.00	0.00%
Chloroform	0.00	0.00	0.00%	0.00	0.00	0.00%
1,1-Dichlo-roethene	0.00	0.00	0.00%	0.00	0.00	0.00%
Ethylbenzene	0.00	0.00	0.00%	0.00	0.001	1.96%
Ethylene Glycol	0.00	0.00	0.00%	0.00	0.18	38.89%
Formaldehyde	0.00	0.00	0.00%	0.00	0.07	1.94%
Hexane	0.00	0.00	0.00%	0.00	0.00	0.00%
Methylene Chlo-ride	0.00	0.00	0.00%	0.00	0.00	0.00%
Naphthalene	0.00	0.00	0.00%	0.00	0.003	1.96%
Phenol	0.00	0.00	0.00%	0.00	0.001	1.96%
Propionaldehyde	0.00	0.00	0.00%	0.00	0.004	1.96%
Styrene	0.00	0.00	0.00%	0.00	0.002	1.96%
Toluene	0.00	0.00	0.00%	0.00	0.002	1.93%
1,1,1 Trichloro-ethane	0.00	0.00	0.00%	0.00	0.00	0.00%
Trichloroethyl-ene	0.00	0.00	0.00%	0.00	0.00	0.00%
Vinyl Chloride	0.00	0.00	0.00%	0.00	0.00	0.00%
o-Xylene	0.00	0.00	0.00%	0.00	0.001	1.96%
As	0.00	0.00	0.00%	0.00	0.000341	1.01%
Be	0.00	0.00	0.00%	0.00	0.00	0.00%
Cd	0.00	0.00	0.00%	0.00	0.000032	0.89%
Co	0.00	0.00	0.00%	0.00	0.00	0.00%
Cr	0.00	0.00	0.00%	0.00	0.000341	1.00%
Hg	0.00	0.00	0.00%	0.00	0.00	0.00%
Mn	0.00	0.00	0.00%	0.00	0.00	0.00%
Ni	0.00	0.00	0.00%	0.00	0.00	0.00%
Pb	0.00	0.00	0.00%	0.00	0.000354	1.00%
POM	0.00	0.00	0.00%	0.00	0.00	0.00%
Se	0.00	0.00	0.00%	0.00	0.000032	0.93%
Total HAPs	0.00	0.00	0.00%	0.00	0.29	3.56%

ETF Complex Air Emission Sources Range of Reported Emissions for Calendar Years 2000-2004						
Description	**ASTF Air Heaters, #30**			**ASTF Test Cells, #31**		
	Minimum (tpy)	**Maximum (tpy)**	**Percent of AEDC Total (tpy)**	**Minimum (tpy)**	**Maximum (tpy)**	**Percent of AEDC Total (tpy)**
CO	0.11	3.75	2.21%	0.00	4.93	2.90%
NOx	0.45	15.00	12.21%	0.00	9.21	7.50%
PM	0.075	2.48	23.39%	0.00	0.057	0.53%
SOx	0.21	5.88	59.10%	0.00	0.74	7.41%
VOC	0.005	0.15	0.60%	0.00	0.396	1.58%
VOC HAP	0.002	0.072	0.90%	0.057	0.34	4.28%
TSP HAP	0.000	0.008	3.05%	0.00	0.001	0.39%
CH4	0.001	0.039	0.33%	0.00	0.00	0.00%
CO2	504.63	16725.00	20.89%	0.00	0.00	0.00%
NH3	0.00	0.00	0.00%	0.00	0.00	0.00%
N2O	0.002	0.08	4.23%	0.00	0.00	0.00%
Acetaldehyde	0.00	0.00	0.00%	0.00	0.019	1.73%
Acrolein	0.00	0.00	0.00%	0.00	0.009	1.73%
Benzene	0.000	0.000	0.03%	0.00	0.008	1.72%
1,3-Butadiene	0.00	0.00	0.00%	0.00	0.007	1.73%
2-Butanone	0.00	0.00	0.00%	0.00	0.00	0.00%
Chloroform	0.00	0.00	0.00%	0.00	0.00	0.00%
1,1-Dichlo-roethene	0.00	0.00	0.00%	0.00	0.00	0.00%
Ethylbenzene	0.000	0.000	0.12%	0.00	0.001	1.72%
Ethylene Glycol	0.00	0.00	0.00%	0.00	0.32	70.71%
Formaldehyde	0.001	0.046	1.27%	0.00	0.061	1.71%
Hexane	0.001	0.020	2.67%	0.00	0.00	0.00%
Methylene Chlo-ride	0.00	0.00	0.00%	0.00	0.00	0.00%
Naphthalene	0.000	0.001	0.61%	0.00	0.002	1.72%
Phenol	0.00	0.00	0.00%	0.00	0.001	1.73%
Propionaldehyde	0.00	0.00	0.00%	0.00	0.004	1.73%
Styrene	0.00	0.00	0.00%	0.00	0.002	1.73%
Toluene	0.000140	0.005	3.63%	0.00	0.002	1.70%
1,1,1 Trichloro-ethane	0.000005	0.000177	79.23%	0.00	0.00	0.00%
Trichloroethyl-ene	0.00	0.00	0.00%	0.00	0.00	0.00%
Vinyl Chloride	0.00	0.00	0.00%	0.00	0.00	0.00%
o-Xylene	0.000002	0.000082	0.18%	0.00	0.001	1.72%
As	0.000013	0.000420	1.24%	0.00	0.000300	0.89%
Be	0.000010	0.000315	78.26%	0.00	0.00	0.00%
Cd	0.000010	0.000315	8.76%	0.00	0.000028	0.79%
Co	0.000	0.00	0.00%	0.00	0.00	0.00%
Cr	0.000010	0.000315	0.92%	0.00	0.000300	0.88%
Hg	0.000010	0.000315	5.51%	0.00	0.000	0.00%
Mn	0.000019	0.000630	73.24%	0.00	0.00	0.00%
Ni	0.000010	0.000315	25.86%	0.00	0.00	0.00%
Pb	0.000029	0.000945	2.68%	0.00	0.000311	0.88%
POM	0.000075	0.002475	88.89%	0.00	0.000	0.00%
Se	0.000048	0.001575	45.65%	0.00	0.000028	0.82%
Total HAPs	0.002	0.08	0.98%	0.06	0.34	4.23%

ETF Complex Air Emission Sources Range of Reported Emissions for Calendar Years 2000-2004

Description	J-6 Steam Plant, #43			ASTF Air Stripper, #45		
	Minimum (tpy)	Maximum (tpy)	Percent of AEDC Total (tpy)	Minimum (tpy)	Maximum (tpy)	Percent of AEDC Total (tpy)
CO	0.00	0.51	0.30%	0.00	0.00	0.00%
NOx	0.00	0.603	0.49%	0.00	0.00	0.00%
PM	0.00	0.046	0.43%	0.00	0.00	0.00%
SOx	0.00	0.004	0.04%	0.00	0.00	0.00%
VOC	0.00	0.033	0.13%	0.298	0.43	1.70%
VOC HAP	0.00	0.011	0.14%	0.101	0.13	1.60%
TSP HAP	0.00	0.000	0.01%	0.00	0.00	0.00%
CH4	0.00	0.014	0.12%	0.00	0.00	0.00%
CO2	0.00	723.60	0.90%	0.00	0.00	0.00%
NH3	0.00	0.019	1.25%	0.00	0.00	0.00%
N2O	0.00	0.013	0.68%	0.00	0.00	0.00%
Acetaldehyde	0.00	0.00	0.00%	0.00	0.00	0.00%
Acrolein	0.00	0.00	0.00%	0.00	0.00	0.00%
Benzene	0.00	0.000	0.00%	0.00	0.00	0.00%
1,3-Butadiene	0.00	0.00	0.00%	0.00	0.00	0.00%
2-Butanone	0.00	0.00	0.00%	0.004	0.004	100.00%
Chloroform	0.00	0.00	0.00%	0.000	0.000	98.73%
1,1-Dichlo-roethene	0.00	0.00	0.00%	0.000008	0.000008	100.00%
Ethylbenzene	0.00	0.00	0.00%	0.00	0.00	0.00%
Ethylene Glycol	0.00	0.00	0.00%	0.00	0.00	0.00%
Formaldehyde	0.00	0.000452	0.01%	0.00	0.00	0.00%
Hexane	0.00	0.011	1.42%	0.00	0.00	0.00%
Methylene Chlo-ride	0.00	0.00	0.00%	0.00	0.001	100.00%
Naphthalene	0.00	0.000004	0.00%	0.00	0.00	0.00%
Phenol	0.00	0.00	0.00%	0.00	0.00	0.00%
Propionaldehyde	0.00	0.00	0.00%	0.00	0.00	0.00%
Styrene	0.00	0.00	0.00%	0.00	0.00	0.00%
Toluene	0.00	0.000021	0.02%	0.00	0.00	0.00%
1,1,1 Trichloro-ethane	0.00	0.00	0.00%	0.00	0.00	0.00%
Trichloroethyl-ene	0.00	0.00	0.00%	0.033	0.071	99.93%
Vinyl Chloride	0.00	0.00	0.00%	0.057	0.063	99.54%
o-Xylene	0.00	0.00	0.00%	0.00	0.00	0.00%
As	0.00	0.000001	0.00%	0.00	0.00	0.00%
Be	0.00	0.00	0.00%	0.00	0.00	0.00%
Cd	0.00	0.000007	0.18%	0.00	0.00	0.00%
Co	0.00	0.000001	0.53%	0.00	0.00	0.00%
Cr	0.00	0.000008	0.02%	0.00	0.00	0.00%
Hg	0.00	0.000002	0.03%	0.00	0.00	0.00%
Mn	0.00	0.000002	0.27%	0.00	0.00	0.00%
Ni	0.00	0.000013	1.04%	0.00	0.00	0.00%
Pb	0.00	0.000003	0.01%	0.00	0.00	0.00%
POM	0.00	0.000000	0.01%	0.00	0.00	0.00%
Se	0.00	0.00	0.00%	0.00	0.00	0.00%
Total HAPs	0.00	0.01	0.14%	0.10	0.13	1.58%

ETF Complex Air Emission Sources Range of Reported Emissions for Calendar Years 2000-2004						
Description	**J-6 Steam Plant, #43**			**ASTF Air Stripper, #45**		
	Minimum (tpy)	**Maximum (tpy)**	**Percent of AEDC Total (tpy)**	**Minimum (tpy)**	**Maximum (tpy)**	**Percent of AEDC Total (tpy)**
CO	0.00	0.51	0.30%	0.00	0.00	0.00%
NOx	0.00	0.603	0.49%	0.00	0.00	0.00%
PM	0.00	0.046	0.43%	0.00	0.00	0.00%
SOx	0.00	0.004	0.04%	0.00	0.00	0.00%
VOC	0.00	0.033	0.13%	0.298	0.43	1.70%
VOC HAP	0.00	0.011	0.14%	0.101	0.13	1.60%
TSP HAP	0.00	0.000	0.01%	0.00	0.00	0.00%
CH4	0.00	0.014	0.12%	0.00	0.00	0.00%
CO2	0.00	723.60	0.90%	0.00	0.00	0.00%
NH3	0.00	0.019	1.25%	0.00	0.00	0.00%
N2O	0.00	0.013	0.68%	0.00	0.00	0.00%
Acetaldehyde	0.00	0.00	0.00%	0.00	0.00	0.00%
Acrolein	0.00	0.00	0.00%	0.00	0.00	0.00%
Benzene	0.00	0.000	0.00%	0.00	0.00	0.00%
1,3-Butadiene	0.00	0.00	0.00%	0.00	0.00	0.00%
2-Butanone	0.00	0.00	0.00%	0.004	0.004	100.00%
Chloroform	0.00	0.00	0.00%	0.000	0.000	98.73%
1,1-Dichlo-roethene	0.00	0.00	0.00%	0.000008	0.000008	100.00%
Ethylbenzene	0.00	0.00	0.00%	0.00	0.00	0.00%
Ethylene Glycol	0.00	0.00	0.00%	0.00	0.00	0.00%
Formaldehyde	0.00	0.000452	0.01%	0.00	0.00	0.00%
Hexane	0.00	0.011	1.42%	0.00	0.00	0.00%
Methylene Chlo-ride	0.00	0.00	0.00%	0.00	0.001	100.00%
Naphthalene	0.00	0.000004	0.00%	0.00	0.00	0.00%
Phenol	0.00	0.00	0.00%	0.00	0.00	0.00%
Propionaldehyde	0.00	0.00	0.00%	0.00	0.00	0.00%
Styrene	0.00	0.00	0.00%	0.00	0.00	0.00%
Toluene	0.00	0.000021	0.02%	0.00	0.00	0.00%
1,1,1 Trichloro-ethane	0.00	0.00	0.00%	0.00	0.00	0.00%
Trichloroethyl-ene	0.00	0.00	0.00%	0.033	0.071	99.93%
Vinyl Chloride	0.00	0.00	0.00%	0.057	0.063	99.54%
o-Xylene	0.00	0.00	0.00%	0.00	0.00	0.00%
As	0.00	0.000001	0.00%	0.00	0.00	0.00%
Be	0.00	0.00	0.00%	0.00	0.00	0.00%
Cd	0.00	0.000007	0.18%	0.00	0.00	0.00%
Co	0.00	0.000001	0.53%	0.00	0.00	0.00%
Cr	0.00	0.000008	0.02%	0.00	0.00	0.00%
Hg	0.00	0.000002	0.03%	0.00	0.00	0.00%
Mn	0.00	0.000002	0.27%	0.00	0.00	0.00%
Ni	0.00	0.000013	1.04%	0.00	0.00	0.00%
Pb	0.00	0.000003	0.01%	0.00	0.00	0.00%
POM	0.00	0.000000	0.01%	0.00	0.00	0.00%
Se	0.00	0.00	0.00%	0.00	0.00	0.00%
Total HAPs	0.00	0.01	0.14%	0.10	0.13	1.58%

ETF Complex Air Emission Sources Range of Reported Emissions for Calendar Years 2000-2004						
Description	T-3 Air Heater, #46			SL1 Test Cell, #53		
	Minimum (tpy)	Maximum (tpy)	Percent of AEDC Total (tpy)	Minimum (tpy)	Maximum (tpy)	Percent of AEDC Total (tpy)
CO	0.00	0.23	0.14%	0.00	8.54	5.02%
NOx	0.00	0.77	0.63%	0.00	18.07	14.71%
PM	0.00	0.021	0.20%	0.00	3.61	34.15%
SOx	0.00	0.002	0.02%	0.00	0.42	4.19%
VOC	0.00	0.015	0.06%	0.00	0.73	2.90%
VOC HAP	0.00	0.005	0.06%	0.00	0.22	2.70%
TSP HAP	0.00	0.000	0.01%	0.00	0.007	2.85%
CH4	0.00	0.006	0.05%	0.00	0.00	0.00%
CO2	0.00	331.50	0.41%	0.00	0.00	0.00%
NH3	0.00	0.009	0.57%	0.00	0.00	0.00%
N2O	0.00	0.006	0.31%	0.00	0.00	0.00%
Acetaldehyde	0.00	0.00	0.00%	0.00	0.035	3.17%
Acrolein	0.00	0.00	0.00%	0.00	0.017	3.17%
Benzene	0.00	0.000	0.00%	0.00	0.015	3.16%
1,3-Butadiene	0.00	0.00	0.00%	0.00	0.014	3.17%
2-Butanone	0.00	0.00	0.00%	0.00	0.00	0.00%
Chloroform	0.00	0.00	0.00%	0.00	0.00	0.00%
1,1-Dichlo-roethene	0.00	0.00	0.00%	0.00	0.00	0.00%
Ethylbenzene	0.00	0.00	0.00%	0.00	0.001	3.17%
Ethylene Glycol	0.00	0.00	0.00%	0.00	0.00	0.00%
Formaldehyde	0.00	0.000207	0.01%	0.00	0.113	3.14%
Hexane	0.00	0.005	0.65%	0.00	0.00	0.00%
Methylene Chlo-ride	0.00	0.00	0.00%	0.00	0.00	0.00%
Naphthalene	0.00	0.000002	0.00%	0.00	0.004	3.16%
Phenol	0.00	0.00	0.00%	0.00	0.002	3.17%
Propionaldehyde	0.00	0.00	0.00%	0.00	0.007136	3.17%
Styrene	0.00	0.00	0.00%	0.00	0.003	3.17%
Toluene	0.00	0.000009	0.01%	0.00	0.004005	3.12%
1,1,1 Trichloro-ethane	0.00	0.00	0.00%	0.00	0.00	0.00%
Trichloroethyl-ene	0.00	0.00	0.00%	0.00	0.00	0.00%
Vinyl Chloride	0.00	0.00	0.00%	0.00	0.00	0.00%
o-Xylene	0.00	0.00	0.00%	0.00	0.001456	3.17%
As	0.00	0.000001	0.00%	0.00	0.002206	6.52%
Be	0.00	0.00	0.00%	0.00	0.00	0.00%
Cd	0.00	0.000003	0.08%	0.00	0.000208	5.79%
Co	0.00	0.000000	0.24%	0.00	0.000	0.00%
Cr	0.00	0.000004	0.01%	0.00	0.002206	6.45%
Hg	0.00	0.000001	0.01%	0.00	0.00	0.00%
Mn	0.00	0.000001	0.12%	0.00	0.00	0.00%
Ni	0.00	0.000006	0.48%	0.00	0.00	0.00%
Pb	0.00	0.000001	0.00%	0.00	0.002290	6.48%
POM	0.00	0.000000	0.01%	0.00	0.00	0.00%
Se	0.00	0.00	0.00%	0.00	0.000208	6.03%
Total HAPs	0.00	0.01	0.06%	0.00	0.22	2.75%

ETF Complex Air Emission Sources Range of Reported Emissions for Calendar Years 2000-2004						
Description	Westinghouse Test Rig, #54			SL2/SL3 Test Facility, #56		
	Minimum (tpy)	Maximum (tpy)	Percent of AEDC Total (tpy)	Minimum (tpy)	Maximum (tpy)	Percent of AEDC Total (tpy)
CO	0.00	3.88	2.28%	0.104	130.30	76.63%
NOx	0.00	12.94	10.53%	0.057	71.59	58.26%
PM	0.00	0.35	3.32%	0.005	6.28	59.30%
SOx	0.00	0.03	0.29%	0.006	7.87	79.16%
VOC	0.00	0.25	1.01%	0.018	22.38	89.20%
VOC HAP	0.00	0.09	1.08%	0.005	6.66	83.04%
TSP HAP	0.00	0.000	0.06%	0.000	0.11	42.89%
CH4	0.00	0.11	0.90%	0.00	0.00	0.00%
CO2	0.00	5550.18	6.93%	0.00	0.00	0.00%
NH3	0.00	0.15	9.57%	0.00	0.00	0.00%
N2O	0.00	0.102	5.21%	0.00	0.00	0.00%
Acetaldehyde	0.00	0.00	0.00%	0.001	1.08	97.45%
Acrolein	0.00	0.00	0.00%	0.000	0.53	97.45%
Benzene	0.00	0.000	0.02%	0.000	0.45	97.08%
1,3-Butadiene	0.00	0.00	0.00%	0.000	0.42	97.45%
2-Butanone	0.00	0.00	0.00%	0.00	0.00	0.00%
Chloroform	0.00	0.00	0.00%	0.00	0.00	0.00%
1,1-Dichlo-roethene	0.00	0.00	0.00%	0.00	0.00	0.00%
Ethylbenzene	0.00	0.000	0.00%	0.000	0.040	97.43%
Ethylene Glycol	0.00	0.00	0.00%	0.00	0.00	0.00%
Formaldehyde	0.00	0.003	0.10%	0.003	3.46	96.54%
Hexane	0.00	0.083	10.87%	0.00	0.00	0.00%
Methylene Chlo-ride	0.00	0.00	0.00%	0.00	0.00	0.00%
Naphthalene	0.00	0.000028	0.02%	0.000107	0.13	97.20%
Phenol	0.00	0.00	0.00%	0.000046	0.058	97.45%
Propionaldehyde	0.00	0.00	0.00%	0.000174	0.219	97.45%
Styrene	0.00	0.00	0.00%	0.000073	0.092	97.45%
Toluene	0.000000	0.000158	0.12%	0.000098	0.12	95.97%
1,1,1 Trichloro-ethane	0.00	0.000001	0.46%	0.00	0.00	0.00%
Trichloroethyl-ene	0.00	0.00	0.00%	0.00	0.00	0.00%
Vinyl Chloride	0.00	0.00	0.00%	0.00	0.00	0.00%
o-Xylene	0.00	0.000000	0.00%	0.000036	0.045	97.42%
As	0.00	0.000002	0.01%	0.000026	0.033	98.28%
Be	0.00	0.000051	12.65%	0.00	0.00	0.00%
Cd	0.00	0.000004	0.11%	0.000002	0.003	87.22%
Co	0.00	0.000065	67.76%	0.000	0.000	0.00%
Cr	0.00	0.000065	0.19%	0.000026	0.033	97.19%
Hg	0.00	0.000012	0.21%	0.00	0.00	0.00%
Mn	0.00	0.000018	2.06%	0.00	0.00	0.00%
Ni	0.00	0.000097	7.97%	0.00	0.00	0.00%
Pb	0.00	0.000023	0.07%	0.000027	0.035	97.76%
POM	0.00	0.000014	0.52%	0.00	0.00	0.00%
Se	0.00	0.00	0.00%	0.000002	0.003	90.94%
Total HAPs	0.00	0.09	1.07%	0.01	6.77	83.10%

ETF Complex Air Emission Sources Range of Reported Emissions for Calendar Years 2000-2004			
Description	**ETF Total**	**AEDC TOTAL (all sources)**	
	Maximum (tpy)	**Percent of Total**	**Maximum (tpy)**
CO	143.14	84.19%	170.03
NOx	89.51	72.84%	122.89
PM	6.68	63.11%	10.58
SOx	9.33	93.85%	9.94
VOC	23.35	93.08%	25.09
VOC HAP	7.43	92.52%	8.03
TSP HAP	0.11	43.74%	0.25
CH4	0.15	1.23%	11.83
CO2	22275.18	27.82%	80077.98
NH3	0.15	9.57%	1.54
N2O	0.18	9.44%	1.95
Acetaldehyde	1.11	100.00%	1.11
Acrolein	0.55	100.00%	0.55
Benzene	0.46	99.63%	0.47
1,3-Butadiene	0.43	100.00%	0.43
2-Butanone	0.004	100.00%	0.004
Chloroform	0.0001	98.73%	0.0001
1,1-Dichloroethene	0.00001	100.00%	0.00001
Ethylbenzene	0.04	99.99%	0.04
Ethylene Glycol	0.45	100.00%	0.45
Formaldehyde	3.56	99.20%	3.59
Hexane	0.10	13.53%	0.77
Methylene Chloride	0.001	100.00%	0.001
Naphthalene	0.14	99.80%	0.14
Phenol	0.06	100.00%	0.06
Propionaldehyde	0.23	100.00%	0.23
Styrene	0.09	100.00%	0.09
Toluene	0.13	98.83%	0.13
1,1,1 Trichloroethane	0.00	79.25%	0.00
Trichloroethylene	0.07	99.93%	0.07
Vinyl Chloride	0.06	99.54%	0.06
o-Xylene	0.05	99.98%	0.05
As	0.03	99.70%	0.03
Be	0.00	90.91%	0.00
Cd	0.00	89.54%	0.00
Co	0.00	67.76%	0.00
Cr	0.03	98.62%	0.03
Hg	0.00	5.72%	0.01
Mn	0.00	75.30%	0.00
Ni	0.00	33.83%	0.00
Pb	0.04	99.31%	0.04
POM	0.00	88.99%	0.00
Se	0.00	95.80%	0.00
Total HAPs	7.53	92.41%	8.15

The listed constituents were the only compounds reported in any year (CY00 - CY04) for the ETF emission sources

The T-3 air heaters (Emissions Source #46) emitted approximately one-fifth of the amount of criteria pollutants and HAPs emitted by the ETF air heaters. Annual operating time is limited under the permit conditions to avoid PSD review requirements.

Steam Plant C (J-6 steam plant; Emissions Source #43) emitted an annual maximum of approximately one-third of the ETF Heaters, and contributes approximately 1% of the total emissions for the entire AEDC complex. This air emissions source operates well within the criteria established under the permit and could be operated to its capacity while still remaining within the permit conditions.

ETF-C, or ASTF, includes the ASTF heaters (Emissions Source #30), ASTF test cells (#31), and ASTF air strippers (#45). These emission sources contribute an annual maximum of approximately 8.7 tpy CO (5% of the AEDC total); 24.2 tpy NOx (20% of the AEDC total); 2.5 tpy PM (24% of the AEDC total); 33 tpy SOx (98% of the AEDC total); 1.0 tpy VOC (4% of the AEDC total); and 0.6 tpy total HAPs (7% of the AEDC total). ETF-A Plant and ETF-B Plant airside facilities have recently been decommissioned; therefore, the ETF-C Plant has become, and will continue to be, the most significant source of air emissions for aeropropulsion testing.

For the ASTF air strippers, the operating time is the limiting factor under the permit conditions. These air strippers are not directly related to testing as their source of water is from groundwater, stormwater and the glycol reboiler condensate line. The air strippers were installed to remove volatiles, specifically TCE and its breakdown products from the west depressed area where TCE spills have historically occurred. The operating time of the air strippers is not expected in increase under the No Action Alternative and is well within the existing permit conditions.

Aeropropulsion tests in the SL-2 and SL-3 test assts, also known as the large engine test facility, were the leading emitters of many NAAQS pollutants and some HAPs at the AEDC. The PSD analysis conducted in August 1995 prior to construction of the facility determined that NOx was the only emission that would be released in significant amounts (PSD 1995). Based on the maximum annual emissions for CY 2000 through 2004, engine tests in these assets accounted for between approximately 60% and 90% of the total AEDC emissions for CO, NOx, particulate matter, and VOCs.

The vast majority of the effluent from the ETF plant exhaust stacks is ambient air constituents including nitrogen, oxygen, water vapor, carbon dioxide, and argon. Diffusion calculations have been performed for NOx and carbon monoxide to assess the ground level concentrations for a human receptor. The calculated emission rates for these compounds, as well as sulfur oxides, hydrocarbons, and particulates, indicated that the emissions to the atmosphere from turbine engine testing in the test cells are insignificant (AEDC 1977). As noted in Section 4.1.4.1.1, *ETF Title V Permit Emission Sources*, release of these NAAQS pollutants is limited under the Title V permit to protect the air resources.

Exhaust from solid propellant rocket engines tested in the J-6 test cell is vented through a scrubber before being discharged to the atmosphere. Approximately 54% of the exhaust from the solid propellant is naturally occurring atmospheric gases, including carbon dioxide, hydrogen, water vapor, and nitrogen. Most of the remaining exhaust released to the atmosphere consisted of carbon monoxide. The only other pollutant discharged from solid propellant firing is hydrogen fluoride. The diffusion calculations show that concentrations of hydrogen fluoride persist for short durations and levels were acceptable to maintain worker protection (AEDC 1977).

Releases of ethylene glycol and dichlorodifluoromethane (CFC-12) to the air are associated with past and ongoing refrigeration operations at the ETF plant. The toxic release inventory (TRI) report for the three year period CY02 through CY04 indicate release of ethylene glycol from point source air emissions ranging from approximately 8,350 pounds per year in CY 2004 to 14,800 pounds per year in CY 2002 (Table 4-5, Appendix K). CFC-12 was released as non-point or fugitive air emission in CY02 and CY04 at annual quantities of 12,900 pounds and 19,900 pounds, respectively. As discussed in Chapter 2, the DoD has only a limited residual supply of CFC-12 and both ethylene glycol and CFC-12 are part of the AFMC-24 reduction program. No adverse impacts have been historically noted and use of these compounds will decrease over time, so no significant impacts from discharges of ethylene glycol and CFC-12 to the atmosphere are expected.

Table 4-5. Toxic Release Inventory Summary
FY 2002 through FY 2004

Contaminant	Release Point/Mechanism	Year		
		FY2002 (lb/yr)	FY2003 (lb/yr)	FY2004 (lb/yr)
Ethylene Glycol				
	Rowland Creek (water discharge)	38,500	26,500	55,956
	Point-Source Emission (stack)	14,800	11,300	8,361
	Other		92	113
	TOTAL	53,300	38,000	64,430
CFC-12				
	Non-Point Source Emission (fugitive) **TOTAL**	12,900		19,900

CFC-12 - dichlorodifluoromethane

Overall, air emissions from all sources within the ETF plant account for approximately 80% of total criteria pollutants and total HAPs within AEDC. However, the air emissions described above are all within the criteria and conditions established by the Title V permit and are not anticipated to cause significant impact to the air quality.

4.1.4.1.2 Proposed Action

The current Title V air permit limits the operational hours of the ETF test assets J1, J2, T3, T4, T11 (Source #19) and the ASTF test assets C1 and C2 (Source# 31) to a combined total of 3,600 hours/year for "air-breathing propulsion engine testing". The maximum actual operating hours from CY 2000 through CY 2005 was 1,816 hours or 50.4% of the permit limit. Similarly, the T-3 air heater (Source# 46) is limited to 416 operating hours/year and has a maximum of 229 hours of annual operation.

Under the proposed action, the aeropropulsion testing would increase by a factor of two in the J, T, and C test assets at AEDC with the exception of T-3 which would be allowed a 45% increase in operations. The major air pollutant emissions will be NOx and CO which are limited to an annual maximum of 176 tons and 83 tons respectively. Based on historic emission data, this increase in test hours would result in 39.4 tons/year of NOx and 21.1 tons/year of CO emissions from the test assets. Operation of the supporting heaters (ETF, ASTF, and T3) would add 2.9 tons/year of CO and 43.3 tons/year of NOx. Since the emission limits are calculated based on fuel usage and operating hours defined in the Title V permit, the projected emissions will not exceed the allowable level and are not considered to have a significant impact on the air quality as long as AEDC remains in an 'attainment' region. Therefore, no air quality impacts are expected for increased aeropropulsion testing associated with the ETF plant asset.

Test assets SL2 and SL3 were evaluated for environmental impacts in a construction and operation environmental assessment (NAWC 1995) and also were required to undergo a PSD analysis (PSD 1995). The initial EA based the air quality impacts on the assumption that the test assets would be limited to 1,000 engine operating hours; however, the actual permit only limits hourly fuel usage and emissions. Initial estimates for NOx and particulate matter were very conservative; however, estimates for CO, SOx, and VOCs were slightly low. Actual emissions for CY 2000 through CY 2005, although higher than estimates, were well within the permitted conditions. The limiting factor for additional operating hours is the CO emissions. Based on historical data, these test assets can increase operations by 31% and remain within permit conditions.

Although the ASTF air strippers are technically a support asset, their emissions are tied to the C1 and C2 test assets. These air strippers are not directly related to testing as their source of water is from groundwater, stormwater and the glycol reboiler condensate line. The air strippers were installed to remove volatiles, specifically TCE and its breakdown products from the west depressed area where TCE spills have historically occurred. Operating time for the ASTF air strippers is the limiting factor under the permit conditions. Under the present permit limits, the air strippers have only an approximate 25% increase potential compared to the maximum annual rate for CY 2000 through CY 2005. As this process is not directly impacted by aeropropulsion testing, these limitations would not apply to test operations. However, some water waste streams (e.g. glycol reboiler condensate) are discharged to the air stripper sump and would increase with increased test frequency and duration. If air stripper operation became a limiting factor, some of the water would be diverted to other discharge routes to reduce the volume of water requiring volatile organic compound (VOC) removal.

Solid rocket testing is permitted within the ETF plant test assets and the PWT plant test assets under Source# 18 and Source#52 respectively. The PWT plant test assets have not performed any rocket testing in the recent past but are permitted for burning 30,300 lbs/year of propellant in conjunction with a wet scrubber. These test assets are also limited by total emissions of 3.22 tons/year of hydrogen chloride (HCl); however, the wet scrubbers have a 100% efficiency (AEDC 1977) which removes HCl from being a limiting factor. Source# 18 is limited by fuel usage per hour and CO emissions. The permitted fuel usage per hour is equivalent to the capacity of the test asset and is an operational limiting factor. The maximum emission of CO during the period CY 2000 through CY 2005 was 7.2 tons/year which is only 4.3% of the permitted capacity.

Liquid rocket testing is also permitted within the ETF plant test assets and the PWT plant test assets under Source# 17 and Source#52 respectively. Propellant usage for this testing is limited to 327,000 lbs/year of Hydrazine fuels and 585,000 lbs/year of Nitrogen Tetroxide. There are no emission limits for this type of testing. Since AEDC no longer has the capability to conduct large scale liquid rocket testing with test asset J4 identified as abandoned, testing under the proposed action will be limited to liquid rockets with self-contained fuel tanks. Any other operations will be evaluated with a separate environmental assessment.

Limits for ETF plant and associated test assets have been based either on a PSD analysis as in the case of SL2 and SL3 or to avoid PSD requirements. In either case, the emissions have been determined by the EPA to not introduce emissions that would significantly affect the surrounding environment. Increasing test operating hours to the maximum permit capacity should not negatively impact the air quality surround the AEDC.

4.1.4.2 Water Quality

4.1.4.2.1 No Action Alternative

Cooling water is used primarily to cool equipment and exhaust gases during test assets as well as to scrub (remove) some of the compounds from the exhaust gas of jet fuel propulsion tests, liquid rocket propellant tests, and solid rocket propellant tests. Non-contact cooling water for equipment cooling is not exposed to contamination and the only change to the water is temperature. Non-contact cooling water is discharged to Rowland Ditch or the retention reservoir.

Contact cooling water is used to scrub (quench) the exhaust gas stream in aeropropulsion engine and rocket engine test assets. The cooling/scrubbing water used during testing of solid propellant rocket engines contains aluminum oxide, hydrochloric acid, and hydrofluoric acid. The hydrochloric and hydrofluoric acids dilute with pre-test and post-test cooling waters The quench water is examined and tested as appropriate before being discharged to the retention reservoir. Any remaining acidity is further attenuated by the natural hardness of the water and dilution in the retention reservoir. Aluminum oxide is a solid that settles out of the water when the quench water is captured in the J-6 dehumidication chamber. Any residual aluminum oxide settles out of solution in the retention reservoir. Accordingly, no significant impacts are associated with solid rocket propellant testing.

Releases of the refrigerant/deicer ethylene glycol are associated with past and ongoing refrigeration operations at the ETF. The TRI reports for the three year period CY 2002 through 2004 indicate release of ethylene glycol to Rowland Ditch ranging from approximately 26,500 pounds per year to 56,000 pounds per year. Ethylene glycol is highly soluble in water, creates increased biological oxygen demand (BOD) in the receiving water (i.e., decreases available dissolved oxygen in the water), and is toxic to aquatic life and mammals. However, impacts are not significant because ethylene glycol biodegrades rapidly in the aquatic environment, releases are periodic, and waters are initially discharged to the retention reservoir where the impacts are attenuated by the large volume of receiving waters prior to offsite discharge. The cooling water in the retention reservoir is recycled to the extent practicable within the AEDC and any water discharged to Rowland Creek and ultimately to Woods Reservoir must comply with the NPDES monitoring requirements, including dissolved oxygen levels to protect aquatic habitat. These practices minimize any potential impacts to the water resource. For these reasons and because no adverse impacts have been historically noted, no significant impacts from discharges of ethylene glycol to water are expected.

Stormwater and other surface water drainage from the ETF plant can become contaminated with oils and solvents. There are five oil/water separators located at strategic points within the ETF plant to ensure that oils and/or fuels are captured before being released to the surrounding ditches or retention reservoir.

Internal monitoring points, controls within the retention reservoir, and monitoring and compliance with NPDES permit requirements mitigate the impact of any discharges to water from AEDC test assets. The retention reservoir is equipped with skimming and absorbent booms, two skimming basins, a turbidity curtain and a pumpback system to prevent release of any petroleum products into waters beyond the NPDES compliance points.

4.1.4.2.2 Proposed Alternative

Increasing the operating hours of the ETF plant and test assets will also increase the demand for both contact and non-contact cooling water. At times, the supply of water may become the limiting factor for testing capabilities. Since the vast majority of water is used for non-contact cooling, temperature will be the major issue. With the installation of fuel/water separators underneath or nearby test cells, the amount of fuel discharged has been significantly reduced. Modification of the retention reservoir to be able to intercept floating contaminants further protects the surrounding aquatic environment.

NPDES permit excursions at Outfall 001 where water is discharged from the retention reservoir to a tributary to Rowland Creek have been rare for the period CY 2000 through 2004. The increase in non-contact cooling water will provide additional flow through the facility which in effect reduces the concentration of contaminants that may be introduced from water used in exhaust quench operations. Accordingly, there is no significant impact to water quality from increased ETF plant and associated test asset operations.

4.1.4.3 Hazardous Materials and Waste

4.1.4.3.1 No Action Alternative

There are twelve reoccurring waste streams associated with the ETF plant (Table J-1). During the period CY2000 through CY2005, WS# 161 – "ETF Contaminated Used Oil" was the only waste stream to generate hazardous waste with a maximum of 575 kg in CY 2000 and a minimum of 169 kg in CY 2002. Under the no action alternative, this trend of relatively small and varying generation of hazardous waste is expected.

Hazardous materials are dispensed through the HAZMAT pharmacy (Figure 3-9) and tracked from distribution through disposal. Hazardous Materials storage cabinets are located at various locations within the ETF plant for storage of materials when not in use. Hazardous material turn-in points are available to return unused hazardous materials.

Hazardous material usage should remain the same. The ordering and dispensing program at AEDC will minimize collection of excess materials and the ordering of extremely hazardous materials unless absolutely necessary.

4.1.4.3.2 Proposed Alternative

Based on Title V air permit limits, operation of the test assets are limited to approximately two times the historic average. Therefore, it would be expected for the hazardous waste from WS# 161 to increase at no more than a factor of two. AEDC utilizes a contract with DRMO to transport and dispose of all base hazardous waste. The potential increase in hazardous waste will no pose a significant impact on the environment as long as it is collected, stored and disposed according to environmental regulations.

Aeropropulsion engine testing would result in more hazardous materials (i.e. jet fuel) purchases. Based on the historic fuel usage from FY 2001 to FY 2005 (Appendix K), approximately 3,000,000 gallons of jet fuel would be required each year to fully utilize the facility. This fuel would be stored at the bulk fuel farm and dispensed as needed.

Since AEDC has adequate procedures in place to handle the fuels and hazardous wastes, no significant impact to the environment is expected from the increased activities.

4.1.4.4 Occupational Health and Safety

4.1.4.4.1 No Action Alternative

Noise is generated at the ETF from engine tests and support systems. Noise levels depend on the testing performed, the size and type of the test article or engine, the mass flow rate, the configuration, and the test unit being used.

Noise is generated from engine tests and supporting systems, including noise from the engine, wind simulation, exhaust, process air compressors and motors. Noise is also generated by the support systems for the test operation, such as the process air compressors and motors, the exhaust systems, and other associated equipment. Noise levels in the immediate area when both support systems and the tests are operating reach approximately 109 dBA. The level considered representative of reasonable maximum noise is approximately 124 dBA, but engine tests are typically brief. Areas are posted with warnings and worker safety programs include hearing protection in compliance with OSHA. Noise levels at the Arnold AFB fence line attenuate to less than 70 dBA. No reports of complaints from the surrounding community have been reported. No significant impact to the environment associated with noise is identified for current ETF operation.

The liquid and solid propellant rocket engine tests are conducted inside of closed test cells that are operated at a vacuum of approximately 0.01 atmospheres. These factors reduce the sound transmitted such that the human ear cannot detect firing of an engine just a few hundred feet away (AEDC 1977). The noise generated from these tests presents no significant impact.

4.1.4.3.2 Proposed Alternative

Increased testing will result in increased duration of elevated noise levels but will not increase the maximum measured values. Industrial hygiene will continue monitoring levels to ensure that workers are not subject to levels which exceed the OSHA requirements for dBA levels or duration.

4.1.5 Other Test Assets

AEDC has other test assets that have very minimal impact on the surrounding environment. Other than the utilities that are required, the facilities have no significant emissions that are discussed within this environmental assessment. Since the operation and impact of the test assets will not change, the overall activities will be discussed in this section but will not include an in-depth evaluation.

Aerospace Chambers Mark I, 7V, 10V, 12V, and 7A maintain extremely low temperatures and pressures (high vacuum) through use of the electrical power consuming cryogenic and vacuum pumping systems. The liquid nitrogen refrigeration system has a capacity of 90 kW and the helium refrigeration system includes a 4-kW and a 3-kW refrigerator with a 0.5-kW and 1-kW helium liquefaction system.

Nitrogen gas is used for preparing the Mark I Chamber, and venting and purging Chambers 7V, 10V, and 12V. The nitrogen is either vented directly to the atmosphere or diluted with ambient air before discharge through vent stacks. Small volumes of nitrogen or helium are sometimes introduced into the Aerospace Chambers during tests and discharged to the atmosphere through the vacuum pump exhaust stack. Where discharge points are not isolated from worker areas, oxygen monitoring systems are used to ensure no oxygen deficient atmospheres exist to ensure worker health and safety.

The DECADE X-Ray Simulation Facility exposes test articles to high energy X-Ray as well as other radiation sources but the power requirements are limited because of the short burst of energy to which the test article is subjected. Accordingly, the power requirements for operations of the Aerospace Chamber refrigeration system and the DECADE facility are incidental in comparison with the energy demands at the VKF and the overall AEDC complex. Various radiation sources generated at the DECADE X-Ray Simulation Facility are a potential personnel safety issue, but worker safety is protected through adherence to the safety program and engineering controls, such as shielding from the radiation source.

These test assets, both for the No Action Alternative and the Proposed Alternative, have no significant impact on the surrounding environment

4.1.6 Utility Assets

Support Assets that are discussed in this section are those that discharge, or have a potential to discharge, either liquid or gaseous pollutants to the environment. Support structures such as stormwater and wastewater distribution systems are not included as they are merely conduits for transport of discharges.

Of the utility assets, only the steam plants and the ETF plant air strippers will be significantly affected by the changes considered under the Proposed Action. As such, the other utility assets will not be evaluated further since they are currently operating in compliance with State and Federal regulations. Also, only the pertinent areas of concern will be addressed.

4.1.6.1 Steam Plants

AEDC has three steam plants (A, B and C) with a total of 6 boilers which provide steam to administrative and test buildings as well as test assets. Steam plant B is currently mothballed and will not be considered in the evaluation. Each boiler is a Title V air source and Steam Plant A also is an internal monitoring point (IMP) on the NPDES permit.

4.1.6.1.1 Water Quality

4.1.6.1.1.1 No Action Alternative

Steam Plant A is covered under NPDES Permit TN0003751 as Outfall 005 and requires monitoring for pH, flow, Oil & Grease, and temperature. During the period CY 2002 through CY 2005, there was a reported flow range of 0.001 mgd to 5.001 mgd and a maximum pH of 8.4. The only regulated parameter for this outfall is pH with an allowable range of 6.5 to 9.0. The other steam plants have no monitoring requirements due the small volume of discharge and infrequent activities. Steam Plant A used an annual average of 47,092,224 gallons of make-up water during the period from FY 2000 through FY 2005 while Steam Plan C used an average of 998,120 during the same period. The limiting factor for steam plant operation will be discussed in the Air Quality Section (4.1.6.1.2 Air Quality). There are no significant water quality impacts from the current operation of the steam plants.

4.1.6.1.1.2 Proposed Alternative

Increased test frequency and test duration would increase the demands on the steam plant operations resulting in more water usage and more frequent boiler blowdown. With the increased flow from non-contact cooling water, the blowdown water impact would be insignificant. Therefore, no water quality impacts are anticipated.

4.1.6.1.2 Air Quality

4.1.6.1.2.1 No Action Alternative

Steam Plant A contains four boilers and is recognized by the Title V permit as 4 separate sources (Source# 1-4). The limiting parameter is operating time with a maximum annual usage of 26,000 hours. During the period CY 2002 through CY 2005, the four sources combined to operate at 74% of the permitted maximum. The maximum heat input is equal to the boiler capacity. The remaining limits are established pursuant to TAPCR 1200-3-26-.02(9)(g). Steam Plant C permit conditions are such that they cannot be exceeded by the equipment operating within the equipment design capacity. Under the No Action Alternative, the steam plants are well within the permit limits and no significant air quality impact is expected.

4.1.6.1.2.2 Proposed Action

Steam Plant A is limited by operating hours and can only increase operating time by 26%. Based on the average values from the CY 2002 through CY 2005 period, the increase would be insignificant and cause no additional air quality issues. Operation of Steam Plant C would remain minimal and also have no impact on ambient air quality.

4.1.6.1.3 Hazardous Materials and Waste

4.1.6.1.3.1 No Action Alternative

Steam Plant A used an average of 116,369 gallons of fuel oil during the period from FY 2000 through FY 2005 while also using 574,072 mscf of natural gas. The trend has been a reduction in fuel oil usage and an increase in natural gas usage over the six year review period. Using the average fuel oil consumption, this translates to approximately one half of a tank of fuel oil being used each year. Compared to the overall base fuel oil usage, the transport and storage of fuel oil for the steam plant is not significant.

4.1.6.1.3.2 Proposed Action

Increasing Steam Plant A operation to maximum annual operating hours would translate to an increase of 26% in fuel oil usage. Based on historic usage, this would still result in less than one tank of fuel oil being used each year. Natural gas consumption would increase dramatically; however, natural gas is delivered via pipeline and no additional hazards are associated with increased use. The proposed action would not have a significant impact on the storage or transport of hazardous materials at AEDC.

4.1.6.2 Air Strippers

There are two air strippers associated with the ETF C-Plant (ASTF) and one associated with ETF B-Plant (Building# 878) which are used to remove VOCs from the area water collection systems. Both areas store large quantities of trichloroethylene and leaks or spills have occurred in the past which has contaminated the groundwater and/or the collection trenches. Each of these assets has a Title V permit limit and is listed on the NPDES permit as an IMP. The AEDC Installation Restoration Program (IRP) operates six additional small air strippers to remediate ground water. These air strippers are incorporated into the NPDES permit and do not have air monitoring requirements.

4.1.6.2.1 Water Quality

4.1.6.2.1.1 No Action Alternative

The ETF C-plant air strippers (IMP 01B) have “report only” parameters for flow, pH and Trichloroethylene. From CY 2002 through CY 2005, the maximum flow recorded was 1.23 mgd, maximum pH was 8.9, and the maximum concentration of TCE was 1902.51 ppb. The ETF B-plant air stripper (IMP 01E) has “report only” parameters for flow, pH and four chlorinated hydrocarbons. During the period reviewed, trichloroethylene was detected only once at a concentration of 4.22 ppb during CY 2003 and a maximum flow of 0.05 mgd. Both of these IMPs discharge to Rowland ditch which has an average flow range of 7 to 86 mgd. Based on these numbers, the discharge for the air strippers is not significant and has little impact on the aquatic environment.

4.1.6.2.1.2 Proposed Alternative

Operation of the air strippers will not be affected significantly by increased duration and/or frequency of testing at AEDC. Since the influent is based on groundwater seepage and facility drainage, the additional test hours will not increase the flow of water through the air strippers nor affect the effluent concentrations of contaminants. The operation of the air strippers will not have a significant affect on the aquatic environment.

4.1.6.2.2 Air Quality

The two air strippers identified in the Title V permit as “ASTF Air Strippers” (Source# 46) and the “Building #878 Air Compressor” (Source# 67) are limited by operating time and VOC emissions respectively.

Source# 46 has reached at 73% of the maximum allowable hours while Source# 67 is emitting less than 1% of the maximum allowable VOCs.

4.1.6.2.2.1 No Action Alternative

Historical data shows that both air stripper sources are operating well within the Title V allowable parameters. Continuation of current conditions will not have any additional impact on the air quality surrounding AEDC.

4.1.6.2.2.2 Proposed Alternative

Source# 46 has approximately 1,300 annual hours of additional operation under the current Title V permit. Source # 67 has the capability to operate at nearly a 1000 fold increase assuming this would not exceed the limiting water input rate of 37,500 lb/hr. Since these assets are not directly related to test asset operation, and since there is potential to redirect some wastewater discharges away from Source # 46, these assets are neither a limiting factor for testing nor do they pose a significant impact on the surrounding ambient air conditions.

4.2 Cumulative Impacts

Cumulative impacts are "the incremental impact(s) of the action when added to other past, present, and reasonably foreseeable future actions" (40 CFR 1508.7). Cumulative impacts include effects from human activities within a specific geographic area and time period that individually may be inconsequential, but can result in the degradation of important resources in conjunction with other impacts. Cumulative impacts can be viewed as the total effects on a resource, ecosystem, or human community resulting from an action in combination with all other activities regardless of their source. Cumulative impacts considered in this assessment are those changes to the physical, biological, or human environments that would directly or indirectly result from the Proposed Action or the No Action alternative in combination with past, present, and reasonably foreseeable future actions, regardless of whether they are associated with AEDC operations.

Cumulative impacts to the natural and human environment are addressed in the following sections. Impacts associated with elements such as air quality are less well defined because of mobility or indirect impacts. Accordingly, the geographic areas assessed differ based on the level of influence and sensitivity to impacts. Common elements are described in the following subsections under the main headings, with differentiating cumulative impacts addressed respectively for the Proposed Action and No Action alternative.

4.2.1 Water

The geographic area considered for cumulative impacts to water resources, including surface water, and wetlands, consists of Arnold AFB and drainage areas immediately adjacent to its boundary. Potential cumulative impacts to water resources result from water used in the AEDC cooling water system, stormwater runoff, and other local area water uses.

The development of the AEDC complex and supporting areas required construction of Woods Reservoir, a 3,632-acre surface water impoundment established on the Elk River, a retention reservoir within AEDC, and surface water drainage systems to control stormwater runoff. These modifications impacted water resources in the region including changes to surface water and wetland hydrology and groundwater recharge. This includes impacts to the AEDC complex, Woods Reservoir and the adjoining drainages, and the areas to the southwest of Arnold AFB. AEDC and its impact on water resources have been present in the environment for over 50 years and current conditions represent a modified hydrologic baseline. The time frame considered for the cumulative impacts to water resources is limited to the period since development of AEDC.

Woods Reservoir was created to provide water for AEDC operations and large volumes of water are withdrawn annually and pumped to the AEDC cooling water and potable water systems. The only other identified authorized withdrawal from Woods Reservoir is for cooling water used at the University of Tennessee Space Institute (UTSI) located at the mouth of Rowland Creek. The amount of water used by UTSI is intermittent and negligible. Water is recirculated through the AEDC cooling water system to the maximum extent practicable, and any water discharged to Rowland Creek for return to Woods Reservoir is routed through retention reservoir where any floating petroleum products are removed, sediment is provided ample time to settle out, and temperature moderated before discharge. All water used for AEDC operations comes from and remains within the Elk River drainage. Stormwater drainage from AEDC is controlled, including a series of pumpback systems to prevent the flow of spent process water into local streams. Arnold AFB facilities outside of the industrialized complex, including operations leased by TNARG, have negligible impact on water resources.

AEDC does not use groundwater for operations. Groundwater uses in the region include small potable water wells across the base and adjacent lands. Former activities associated with AEDC operations may have contributed directly or indirectly to groundwater contamination, potentially affecting its consumptive use. Activities under the AEDC IRP minimize the potential for migration of groundwater contamination and current management systems minimize the risk of any future releases.

Wetlands within Arnold AFB are managed through the conservation program to prevent and mitigate any negative impacts from base activities.

4.2.1.1 Proposed Action

AEDC is the predominant user of water within the assessment area, and continued operation under the Proposed Action would result in comparable use and management of water resources. Accordingly, no significant cumulative impacts to water are anticipated for the Proposed Action.

4.2.1.2 No Action Alternative

Cumulative impacts to water resources from continued AEDC operations over the near term and long term for the No Action alternative would be comparable to those for the Proposed Action.

No significant cumulative impacts to water resources are anticipated for the No Action Alternative.

4.2.2 Air Quality

The geographic area considered for cumulative impacts to air resources includes the region of Arnold AFB and the local communities with substantial air emission sources (Tullahoma and Manchester). The time frame considered for impacts to air quality is limited to the period after implementation of the Clean Air Act Amendment (CAAA) of 1990 when air emission requirements substantially changed. Air emissions prior to 1990, and particularly prior to the 1970 passage of the Clean Air Act (CAA), generally were less controlled and air quality was often degraded even though there were fewer air emission sources at the time. Regulation under the CAAA provided for measures to prevent further significant degradation of air quality and to reverse previous impacts.

Past and present test assets at the AEDC complex, including the utilities required to support the test assets such as offsite power generation by TVA and onsite steam production, have had the most impact on air quality. These sources are controlled under a Title V air quality operating permit and other requirements under the CAAA to minimize impacts. Other contributing sources of air emissions include indirect sources such as vehicle emissions from commuting workers, transportation of supplies, and the AEDC vehicle fleet.

Offsite air emission sources include various operations in the Tullahoma area, mobile sources (regional traffic), and intermittent air emissions from the air field and TNARNG tank maneuvers. AEDC is surrounded by a large buffer zone in which limited air emission sources are located. Consequently, air emissions from the AEDC testing and support operations are naturally attenuated to a great extent by the air dispersion (diffusion) capacity before mixing with offsite sources. The baseline air emissions from AEDC and the surrounding communities have continued for many years with no reports or cause to suspect significant degradation of air quality. While surrounding communities (primarily Tullahoma) have air emission sources potentially affecting air quality, cumulative impacts to regional air quality from AEDC baseline operations and surrounding communities are not significant.

4.2.2.1 Proposed Action

Future cumulative impacts under the Proposed Action would not be anticipated to be significant for air quality in the region. The regional economy is stable with measured growth from several business sectors. No known major industrial projects are planned for the region, and any currently unplanned industrial air emission sources would be subject to regulation under the CAAA to minimize impacts. Similar to economic growth, population growth in the region is also measured and stable. Air emissions associated with vehicle use and increased power production is not anticipated to substantially increase.

AEDC and other major sources in the region are subject to the NSR program for attainment areas for new or modified sources triggering PSD requirements. The PSD program presumes non-qualifying new or modified sources do not have significant impact on the air resource. A qualifying source triggering a PSD review does not necessarily represent a significant impact, but rather requires the owner of the emission source to perform an air quality assessment to demonstrate that new emissions in combination with existing area sources would not cause or contribute to a violation of any NAAQS or PSD increment. Best available control technology (BACT) would be designed and implemented as part of the PSD program. Such measures would minimize any cumulative impacts to regional air quality.

Incremental, cumulative future growth at AEDC and in the region, although limited, could potentially cause some degradation of the present air quality. Future regulatory restrictions and new air emission controls, such as low-emission vehicles and BACT requirements on power plants and other sources, would mitigate cumulative air quality degradation. Accordingly, no significant cumulative impacts are anticipated to air quality for the Proposed Action.

4.2.2.2 No Action Alternative

Cumulative impacts to air quality for continued operations under the No Action alternative would be the same as for the Proposed Action.

4.2.3 Utilities and Infrastructure

Utility systems for water supply, treatment, and discharge, sanitary sewerage, and steam supply are self-contained within AEDC, as would be any impacts associated with these systems for implementation of the

Proposed Action or No Action alternative. Cumulative impacts associated with utility use and infrastructure considers the use of electricity and natural gas from off-base utility providers. The timeframe considered for cumulative impacts is the period beginning with development of Arnold AFB when electrical and natural gas infrastructure was built to supply the base. Jet fuel is supplied the AEDC liquid fuels storage and distribution system from the DESC in Bremen, Georgia and these supplies have no local direct or indirect impacts, as there is no significant off-base use of jet fuel in the region. Diesel fuel and unleaded gasoline are supplied to the AEDC storage and distribution system by local contractors, which import their supplies form sources outside of the region.

Initiation of test assets at the AEDC created a sudden and substantial increase in demand for electricity and natural gas that had a significant impact at the time. Additionally, development of the base caused a sudden rise in population and community development that concurrently increased the off-base demand for electricity and natural gas. After this significant initial change in demand, electrical usage and natural gas consumption has remained comparable for the last several decades as the growth of the AEDC mission, the regional population, and the community development have remained steady or slowly increased. Current conditions represent a new baseline.

4.2.3.1 Proposed Action

The Proposed Action would continue utility usage comparable to current baseline conditions, with potential incremental increases over time associated with new or expanded testing capabilities. The growing population and economy in the region would also require incrementally greater use of electricity and natural gas supplies. No known large-scale industrial or commercial projects are currently planned for the region that would result in a sudden increases in demand for electricity or natural gas requirements The basic existing infrastructure can accommodate reasonable increases is demand with local systems modifications Accordingly, no significant cumulative impacts are anticipated for implementation of the Proposed Action.

4.2.3.2 No Action alternative

Cumulative impacts to utility infrastructure would be comparable to those for the Proposed Action. Over the long term, demand would diminish on-base with a concomitant potential for reduction in regional utility usage if facilities became obsolete and operations were significantly reduced or discontinued. No significant cumulative impacts for utility use or infrastructure are anticipated from implementation of the No Action alternative.

4.2.4 Waste Disposal

The geographic area considered for cumulative impacts from waste disposal includes the region of Arnold AFB and local communities with municipal solid waste landfills, and disposal of hazardous waste at remote permitted RCRA Subtitle C hazardous waste treatment, storage, and disposal facilities (TSDF).

Initiation of test assets at AEDC created an increase in the volume waste generated in the region. During this period, waste was not recognized as the threat to land, air, water, flora, fauna, and human health that it is today and therefore was not necessarily disposed in a manner that protected these resources. As waste minimization efforts were not yet mandated or generally recognized, the generation of waste volumes was not managed as it later came to be. Accordingly, waste generation associated with the initiation of test assets at the AEDC represented a new and sudden potential for impacts to the environment.

The USAF complies with all relevant laws and regulations and has developed its own directives and programs to minimize impacts from waste generation. Pollution prevention measures endeavor to continually reduce the amounts and types of hazardous materials used and volume of generated waste.

RCRA hazardous wastes from AEDC are disposed of at an offsite licensed TSDF used by various other waste generators. The volume of hazardous waste from AEDC, which averaged approximately 16,500 kilograms (18 tons) annually for CY 2000 through 2005, is a negligible percentage of the total hazardous waste disposed of in a single TSDF. There is adequate capacity at commercial facilities for disposal of hazardous waste generated by AEDC at current levels in combination with waste from other generators. Likewise, there is sufficient capacity for non-hazardous waste provided by the on-base construction and debris landfill and off-base facilities within the region.

4.2.4.1 Proposed Action

Continued operations under the Proposed Action would generate volumes of solid and hazardous wastes comparable to current volumes, with incremental increases potentially resulting from new operations and incremental decreases potentially resulting from improvements in pollution prevention measures. The most substantial changes in AEDC waste volumes would result from demolition of structures to eliminate outdated facilities and consolidate operations. Demolition-derived waste would be minimized to the extent practicable through recycling and waste volume minimization. Continued growth in the region would result in an increased volume of solid and hazardous waste from residential, commercial and industrial sources. Sufficient commercial and municipal capacity exists for these combined sources, and no significant cumulative impacts are anticipated for waste disposal associated with implementation of the Proposed Action.

4.2.4.2 No Action Alternative

Cumulative impacts associated with waste disposal over the near term for the No Action alternative for continued operation would be comparable to those for the Proposed Action. Over the long term, a reduction in operations resulting from obsolescence of facilities could reduce the volume of waste generated at AEDC. Off-base waste generation in the region might also drop if a significant reduction or discontinuation of AEDC operations reduced the level of commerce and residency in the area. Over the long term, demolition of obsolete facilities could result in the generation of large waste volumes. Demolition-derived hazardous waste volumes could be accommodated by existing commercial facilities. The volume of non-hazardous waste could potentially exceed the capacity of the on-base construction debris landfill. If this volume could not be accommodated on base, disposal in regional landfills could result in a significant cumulative impact associated with solid waste disposal.

4.2.5 Noise

The geographic area considered for cumulative impacts from noise consists of Arnold AFB and the adjacent communities near the boundary of the Base. The time frame considered for cumulative impacts is the period beginning with the development of Arnold AFB when land use was changed from mostly undeveloped and agricultural uses. Noise introduced by construction and operation of AEDC represented a significant impact at that time. Current conditions represent a new baseline. Testing and support operations and other activities on Arnold AFB include workforce hearing protection.

Combined sources of noise generated from multiple test assets within the AEDC complex can occur, but are temporary and intermittent as total testing time is relative short in duration and concurrent testing is often limited by power requirements and other infrastructure constraints. The only substantial noise generation from non-testing activities at Arnold AFB is associated with use of the airfield west of the AEDC complex near the Arnold AFB boundary and periodic tank maneuvers by the TNARNG. The airfield is infrequently used and the airfield and surrounding land uses comply with the USAF Air Installation Compatible Use Zone (AICUZ) program requirements (AFI 32-7063). While the airfield is near the base boundary, there is limited off-base development in this area. The infrequent use of the airfield in combination with AEDC operations does not create significant impacts from noise.

TNARNG training operations at the tank range can include operation of multiple tanks, with training generally performed a maximum of once per month. The tanks generate noise comparable with other track-type, diesel-fueled heavy equipment, which is approximately 75 dBA each. AEDC test assets are approximately 5 miles from this source, and the maximum noise level at the tank training site cumulatively from the tanks and AEDC would be a maximum of 83 dBA. Considering sound attenuation with distance, the criterion for significance of 65 dBA would be achieved at a distance of less than 500 feet from tank operation. As the distance to the base boundary is greater than this distance, no off-base significant cumulative impact from noise would be anticipated from combined tank training and test assets.

The extensive buffer zone around AEDC attenuates noise from operations to off-base areas. Off-base sources of noise near the base boundary in surrounding communities include industrial operations, traffic, and construction activities. Because these sources are far removed from the base and sound attenuates over distance, there would negligible potential for cumulative impacts from combined on-base and off-base noise.

4.2.5.1 Proposed Action

Continued operations at AEDC under the Proposed Action would generate noise levels comparable to current operations, and no cumulative impacts are anticipated from its implementation.

4.2.5.2 No Action Alternative

Cumulative impacts from noise over the near term for the No Action alternative would be comparable to those for the Proposed Action. Over the long term, generation of noise associated with testing would reduce commensurate with any reduction in operations over time. Noise associated with any future land reuse can not be projected, but would likely be less that that currently generated at AEDC. No cumulative impacts associated with noise are anticipated from implementation of the No Action alternative.

4.3 Irreversible and Irretrievable Commitment of Resources

Both the Proposed Action and the No Action alternative would irreversibly and irretrievably commit resources including petroleum products, natural gas, resources used to produce electricity, chemicals, various construction materials, and land.

Test assets directly use jet fuel. Petroleum products are also consumed in heaters, boilers, and vehicles for general base operations. AEDC uses an annual average of approximately 2.65 million gallons of petroleum products, including various jet fuels (primarily JP-8), diesel fuel, and unleaded gasoline based on data from FY 2000 through 2005.

Operation of AEDC, including test assets, support facilities, and other related activities, requires substantial amounts of electrical power. The annual average consumption of electricity is approximately 380,000 MWH, or enough electrical power to supply about 26,500 homes. AEDC spends an average of $18M per year on electricity. The TVA primarily uses fossil fuels to generate this electricity.

AEDC consumes an average of over 600,000 million cubic feet of natural gas per year to operate heaters, dryers and steam boilers for facility heating and test assets. This volume of natural gas is enough to supply approximately 7 million homes.

Various chemicals are used in support to testing and general AEDC operations, representing a commitment of resources. The use of these chemicals results in generation of approximately 18 tons of hazardous wastes per year requiring disposal in a RCRA Subtitle C TSDF, representing a commitment of land and the resources for disposal facility maintenance. While an aggressive pollution prevention program minimizes the hazardous materials used and consequent generation of hazardous wastes, the use of hazardous materials and associated waste generation will continue for future AEDC operations. Likewise, solid waste generation from base operations requires disposal, committing land and resources for disposal facility maintenance.

The Proposed Action would require the use of common construction materials that would be irretrievably committed, such as concrete, structural steel, and wood, and would irretrievably consume various types of fuel for construction. There would potentially be less irreversible and irretrievable use of resources associated with testing over the long-term for the No Action alternative. Demolition of obsolete facilities would require the irreversible and irretrievable use of natural resources including fossil fuels, but could result in the recovery very large amounts of reusable and recyclable materials, such as structural steel.

4.4 Compatibility of the Proposed Action with Objectives of Federal, State, and Local Land Use Plans, Policies, and Controls

AEDC serves a vital military research function in support of the larger USAF and DoD mission to provide security to the nation and its allies. The Proposed Action would allow AEDC to continue to serve in this capacity, and to continue to meet requirements under Public Law (PL) 81-415, Titles I and II: The Unitary Wind Tunnel Plan Act of 1949 and The Air Engineering Development Center Act of 1949. The Proposed Action would be compatible with existing federal, state, and local land use plans, policies, and controls. Over the long term, the No Action alternative would not allow AEDC to continue to meet its mission and could significantly impact land use on and near the base.

AEDC and the surrounding communities have worked together over the last several decades to establish and maintain appropriate and compatible land use patterns, including land transfers and public use of areas within Arnold AFB. The AEDC complex is surrounded by a generous buffer zone that serves many purposes, including sound attenuation, attenuation of air emissions, security, and elimination of visual impacts from the industrial facilities. The benefits of this buffer zone include a minimization of impacts to off-base land use in the adjoining communities.

4.5 Relationship Between Short-Term Uses of the Environment and Long-Term Productivity

Continued operations under the Proposed Action or No Action alternative would involve use of already disturbed areas within the AEDC complex. No croplands, wooded areas, or other natural resources would be significantly modified or affected and productivity of the areas would not be degraded. AEDC testing and support operations have provided valuable military and commercial research data and other information for several decades with no reported significant impacts to the environment. Both the Proposed Action and the No Action alternative would continue these essential operations consistent with established operational procedures and health, safety, and environmental management systems. Short-term continued use of the environment would be consistent with the baseline conditions.

5.0 PLAN, PERMIT, AND MANAGEMENT REQUIREMENTS

This section addresses the permits required, the management system modifications necessary, and any plans that would be required to implement the Proposed Action. Existing safety, health and environment management systems are presented in Section 2.2. Following is a summary of the primary regulatory requirements, permits, approvals, consultations, and management plan updates potentially applicable to or required for the Proposed Action:

- Air quality regulations, which may require a construction permit, new source review (NSR) for an attainment area [including a prevention of significant deterioration (PSD) program review], and modification to the Title V Major Source Operating permit. These air regulations can also include controls for other emission sources, such as fugitive dust from demolition and exhaust from heavy equipment and other mobile sources.
- Water quality regulations, which may require modification to the NPDES permit and the NPDES stormwater permits and issuance of an NPDES stormwater construction permit.
- Solid and hazardous waste regulations, which may require modification to the AEDC RCRA Part A and Part B permit. These requirements also potentially include requirements for handling, storage, and disposal of other regulated wastes, such as PCB and asbestos from demolition activities.
- SHPO consultation for any impacts to potential cultural resources, such as modifications or demolition of existing structures potentially of historic concern that may require a memorandum of agreement between the USAF and SHPO. Compliance with the NHPA and Archaeological Resources Protection Act would also be verified through the SHPO consultation.
- Occupational safety and health regulations and DoD and USAF safety requirements, which would be complied with during the AEDC safety review program. No specific permitting, licensing, or consultation is required with OSHA. Instead, all new testing procedures and changes to procedures would be developed internally at AEDC in compliance with OSHA, DoD, and USAF safety program requirements.
- Section 7 consultation with USFWS for protection of TC&E species if activities were proposed that could potentially affect identified TC&E species in the area. Under both the Proposed Action and No Action alternative, all proposed activities would occur within the AEDC complex where no viable habitat remains for TC&E species. Therefore, consultation with USFWS would only be required if unforeseen future activities directly or indirectly impact habitat outside of the AEDC complex where TC&E habitat may remain.
- Management plan updates as necessary, such as updates to the Solid Waste and Hazardous Waste Management Plans, HAZMAT Distribution Plan, Spill Prevention Control and Countermeasure Plan, Pollution Prevention Plan, Biological Resource Conservation plans, and others. These management system plans are reviewed and updated periodically, but would specifically be reviewed and updated to address new activities. For example, demolition activities under the consolidated facilities projects would generate substantial construction debris from the demolition of multiple structures. The solid waste management plan would have to be reviewed and updated as appropriate to address the changed conditions and potential new requirements (e.g., recycling of structural steel).

Permits, licenses, and approvals required for implementation of the Proposed Action would be reviewed, but specific permitting and other regulatory requirements would depend on the specific project parameters that cannot yet be determined. Determinations would be made during the planning of each component of the Proposed Action and addressed individually. The No Action alternative would be limited to continuation of existing testing operations with only limited modifications, so no permitting or consultation would be required except for demolition activities (e.g., stormwater construction permit).

The CWA and TWQCA as implemented by the TDEC Division of Water Pollution Control (TDEC/WPC) prohibits any person from causing a condition of pollution in state waters or altering the physical, chemical, radiological, biological, or bacteriological properties of state waters without the authority of a permit. TDEC/WPC has been empowered to exercise general supervision and control over the quality of all state waters, to administer and enforce all laws relating to pollution of such waters, and to administer and enforce all laws consistent with the purposes of the TWQCA (TCA 69-3-101). An operation that creates a point source discharge is regulated by the Act, including the necessity to obtain any appropriate permits. No impacts to waters of the United States or Waters of the State of Tennessee would occur in the near-term, so no modification to the existing NPDES water discharge permit would be necessary.

No wetlands are anticipated to be disturbed, so there would be no need for CWA Section 404 permitting from the U.S. Army Corps of Engineers. No discharges to waters of the State of Tennessee, filling of wetlands, or alteration of stream channels are anticipated, so there would be no need to obtain a CWA Section 401 water quality certification or a Tennessee Aquatic Resources Alteration Permit (ARAP) from TDEC/WPC. However, if construction or demolition activities or new testing operations caused any of these effects, consultation with TDEC/WPC would be initiated to review the requirements for 404(c) permitting, 401 water quality certification, ARAP, and/or other permitting and regulatory requirements.

A Title V Major Source Operating Permit (No. 546264), pursuant to the Tennessee Air Quality Act and issued in accordance with the provisions of the Tennessee Air Pollution Control Regulations, conditions the operations of specific emission sources and activities generating air contaminants. The Tennessee Air Pollution Control Board issued the permit effective through 08 May 2007 (Appendix E). Consultation with TDEC for modifications to existing facilities would establish those changes constituting major modifications requiring review and modification of the existing Title V operating permit.

The RCRA Part B permit for the AEDC conditions the handling, storage, transportation, disposal, and other management of hazardous wastes generated. New or modified testing operations may require modification to the Part B permit. Consultation with TDEC would be initiated through the AEDC Hazardous Waste Operations Group to determine and establish requirements for continued compliance with RCRA and the Part B permitting requirements.

Coordination with the SHPO would be required for activities affecting existing facilities, any site potentially eligible for listing on the NRHP, and in areas that have not previously been surveyed. Coordination with SHPO would be maintained to ensure that no impacts to potential cultural resources cause irreparable damage. All areas that have not been previously surveyed for cultural resources would be surveyed prior implementation of activities. A memorandum of agreement between the USAF and SHPO would be negotiated to establish the terms for compliance with the NHPA and Archaeological Resources Protection Act.

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Final Environmental Assessment

Test Operations at Arnold Engineering Development Center

Prepared for Department of the Air Force Arnold Air Force Base, Tennessee

(Volume II)

June 2008

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TABLE OF CONTENTS
VOLUME II

Page

List of Appendices

APPENDIX A

Air Force Form 813

Environmental Impact Analysis: 2006 - 000753 - AEDC Testing Operations		
From: SHERRILL-PA	**Proponent Org:** AF/SDE	**Project:** N/A

Purpose And Need: Arnold Engineering Development Center (AEDC) was sited and constructed in response to the passage of Public Law (PL) 81-415, Titles I an II: The Unitary Wind Tunnel Plan Act of 1949 and The Air Engineering Development Center Act of 1949. This law directed development of an advanced aerodynamic research center, supporting the national need for a technologically superior military. AEDC and its activities fall under the Air Force Materiel Command (AFMC). The mission of the AFMC is to advance and use technology to acquire and sustain superior systems. AEDC is a national aerospace ground test center employing approximately 2,700 personnel and $6.0B in facilities, and is currently the world³ most diverse complex of aerospace flight simulation test facilities. Its primary mission is to conduct tests and simulations for aerodynamics, aeropropulsion, and aerospace systems. The center conducts development, certification, and simulated flight testing in support of Department of Defense, commercial and international propulsion, aerodynamic, reentry, trans-atmospheric, and space-flight systems. Testing is performed in an environment that simulates operational conditions. Additionally, AEDC performs research to develop new test capabilities, facilities, and technologies for future simulated flight testing. Ongoing and future operations at AEDC are necessary to maintain military superiority and to continue to meet the requirements of PL 81-415. The previous comprehensive evaluation of potential environmental impacts from mission activities at AEDC, the Formal Environmental Assessment for Arnold Engineering Development Center Operations, was completed in 1977 (1977 Formal EA). Actions subsequent to 1977 have been evaluated independently through the Air Force³ Environmental Impact Analysis Process (EIAP) under the umbrella of the 1977 Formal EA, where appropriate. In order to facilitate continued compliance with the National Environmental Policy Act (NEPA) and implementing regulations, the evaluation of AEDC mission testing is being updated under the EIAP to comprehensively address ongoing actions and any cumulative impacts of current and proposed functions falling within the overall scope of AEDC³ testing mission.

Description And Alternative: Proposed Action: Continued Testing at AEDC with Future Upgrades and New Construction The proposed action for AEDC mission testing is to continue operation with future enhancement of testing capabilities to anticipate and meet changing military and commercial client needs. Under this action, existing facilities would be modified and upgraded and new facilities would be constructed as needed. Consolidation of operations would be used as appropriate to improve infrastructure efficiency, allow compatible land use patterns to evolve, enhance security, and provide for greater environmental protection, consistent with the òight size principles of the AEDC General Plan (revised June 2003). Activities under the proposed action would include currently planned modifications and consolidation to improve high-altitude simulation capabilities for jet- and rocket-engine testing. Evaluation of impacts associated with implementation of the proposed action requires analysis of ongoing operations, proposed testing capability enhancements, and any cumulative impacts of ongoing and proposed testing operations. Enhancement of testing capabilities associated with the proposed action includes currently planned phases of development that are reasonably anticipated to be implemented through fiscal year (FY) 2010. The testing conducted at the facility complexes as well as the associated technical support functions are included in the proposed action. Environmental impacts specifically associated with new construction as well as those associated with demolition of existing facilities are addressed in detail under separate EIAP efforts. AEDC occupies approximately 3,700 acres of the nearly 40,000-acre Arnold Air Force Base (AFB) and is located in Coffee County, Tennessee. Arnold AFB lies within portions of both Coffee County (49,900 population) and Franklin County (39,990 population), Tennessee. The largest community near the installation is Tullahoma, Tennessee, with over 17,900 residents. Arnold AFB provides direct employment to approximately 2,700 people with an annual payroll of over $186 million. Approximately 90 percent of AEDC³ work force is comprised of private businesses and contract civilians. AEDC is also responsible for creating almost 2,000 secondary jobs in the surrounding area and has an annual estimated total economic impact on the local community of approximately $382 million. Testing associated with AEDC³ three primary mission components, aerodynamics, aeropropulsion, and aerospace (space and missile) systems, is conducted within three test facility complexes: the Propulsion Wind Tunnel (PWT), the Engine Test Facility (ETF), and the von Karman Gas Dynamics Facility (VKF). Testing operations at these facilities are supported by a variety of services including engineering, facility maintenance, test documentation, and analytical laboratory services. ETF supports aircraft, missile, and spacecraft propulsion system research and development by conducting simulated flight tests over a wide range of Mach numbers and altitudes, providing data at precisely controlled conditions required to determine operational characteristics of aeronautical and astronautical propulsion systems. Testing accomplished at ETF includes the evaluation of air-breathing engine performance, engine/inlet dynamics, engine operability transients, engine aeromechanical behavior, engine mission simulations, engine/aircraft inlet and components/missile mission simulation, ice accretion, engine durability or altitude accelerated mission testing, altitude performance, rocket nozzle vectoring and development, stage separation, rocket heat transfer, rocket exhaust plume radiation and gas dynamics, space radiation, high-altitude rocket plume characteristics, rocket vehicle systems operability, air-augmented rocket performance, rocket (solid propellant) performance while spinning, and extreme temperature evaluations of space motor nozzles. The PWT includes two 16-ft tunnels, the PWT 16T and PWT 16S, and the Aerodynamic Wind Tunnel 4T. The PWT 16-ft tunnels are used primarily for testing the aerodynamic performance of full-scale engine installations, large aircraft models, and large- and full-scale missiles, or for store-separation testing. The 4-ft transonic tunnel is used primarily for store-separation testing, but can be used for sting-mounted force and pressure tests of aerodynamic models or dynamic stability testing. Another transonic wind tunnel, 1T, which has a 1-ft-square test section and is normally used for research, can be made available on a limited basis for user tests. The VKF is comprised of wind tunnels, ranges, arcjets, and aerospace chambers. The aerodynamic test units and associated equipment allow testing of relatively large-scale models of high-speed aircraft, missiles, and spacecraft in a Mach number range extending from 1.5 to 10. Included in the test units are conventional, continuous-flow tunnels; intermittent blowdown tunnels; continuous-flow arc-heated facilities; and free-flight ranges for both impact and aerodynamic tests of gun-launched models. Air is the working fluid used in all VKF wind tunnels. The ability to vary density allows controlled variation of the Reynolds number throughout a wide range. The aerospace chambers provide for spacecraft testing at all system levels and include sensor calibration and mission simulation, thermal vacuum, radiation effects, and contamination testing. Simulated space conditions include space vacuum and cryogenic temperature, space thermal radiation environment, threat simulations, and vehicle vibration. Mission support services include information support, software and hardware, and computer assisted design instrumentation; lab services encompassing chemical, metallurgical, and nondestructive x-ray sample analysis in support of testing programs and environmental projects; state-of-the-art machining, welding, sheet metal, and precision measuring capabilities used in the fabrication, refinement, and modification of test models, calibration and thrust measurement devices, and test facilities; photographic, graphic technical documentation, and publication support; and fire, safety, and security personnel. AEDC³ testing and simulation capabilities allow for advanced technology development relative to aerodynamics, aeropropulsion, and aerospace systems. AEDC is currently the nation³ largest and most advanced aerospace, ground test evaluation, and simulation facility, providing the world³ most effective aerospace ground test products and services. Simulated ground testing made possible through the Center³ capabilities reduces the time required for flight tests, thereby minimizing the associated risks and expense. The Center³ continued operation and ongoing ability to change in response to emerging technologies and customer needs is necessary to support the AFMC³ mission; maintain a technologically superior military; and facilitate continued compliance with PL 81-415 and governing policies regarding military superiority and national security. Any environmental impacts from discharges or waste generation from future enhancements to testing capabilities under the proposed action would be mitigated through engineering controls and compliance with operational and discharge permit requirements, facility spill and response plans, and waste management plans. Additionally, testing would likely remain confined to the central, developed portion of Arnold AFB, thereby limiting the impacted environment; however, there could be an increased potential for environmental impacts associated with an increased level of testing. Employment in the surrounding community would be expected to remain comparable to the current conditions under the proposed action, with the potential for increased manpower needs associated with new construction. Failure to implement the proposed action could reduce, over time, AEDC³ and the AFMC³ ability to support its mission of advancing the use of technology to acquire and sustain systems, thereby compromising their overall ability to maintain and advance the country³ technologically superior military capabilities. A reduction in the ability to ground test emerging technologies and products could result in an increased need for flight testing, which could in turn result in an increased risk to human life and property. An increase in the number of flight tests could also result in an increased potential for release of pollutants to the environment, including direct emissions to the stratosphere. The future development of new systems and capabilities could be hampered or rendered unfeasible, as certain technology advancements and systems development would be impracticable without adequate ground testing. Any reduction in operations at AEDC over time resulting from obsolescence of testing facilities and failure to replace them with updated facilities would result in a reduction in the workforce needed to support testing operations. Alternatives to the Proposed Action The EIAP for continued mission testing and the evaluation of alternatives to the proposed action build upon the 1977 Formal EA as supplemented by subsequent amendments. The 1977 Formal EA presented testing at AEDC as the proposed action, and evaluated three alternatives that were screened from detailed analysis. These alternatives are summarized below with the rationale for their initial screening, as well as additional discussion based on relevant portions of the subsequently promulgated DoD Title 32, Part 989, Environmental Impact Analysis Process (1999). a) Not conducting the tests. This alternative (no action) was screened from detailed analysis in the 1977 Formal EA as not meeting the AEDC mission requirements to support development of sophisticated aerospace systems, as these systems could not be developed without testing at full flight conditions or simulated conditions. This no action alternative meets the definition of èighly speculative under the subsequently promulgated Title 32, Part 989.8(b) which states that Ôhe Air Force need not analyze highly speculative alternatives, such as those requiring a major, unlikely change in law or government policy. Discontinuing testing operations at AEDC is highly speculative as its siting, development, and operation was carried out in response to PL 81-415, and the facility continues to fulfill the purposes of Titles I and II of this law. b) Conducting the testing at another facility. This alternative was screened from detailed analysis in the 1977 Formal EA on the basis that 1) testing at another facility might only serve to alter the location of any environmental impacts rather than eliminate them, 2) development of another test facility with capabilities comparable to those at AEDC would be impracticable because of the excessive cost that would be required, and 3) a site comparably suitable for development of an alternative facility would be difficult to find, as the AEDC setting affords a remoteness not typically found in conjunction with an ample water and power supply and a technically proficient local labor pool. c) Flight testing. This alternative was screened from detailed analysis in the 1977 Formal EA on the basis that 1) flight testing would be primarily applicable only to rocket and air-breathing engines and could not be used to substitute for all types of testing accomplished at AEDC, 2) flight testing is not a satisfactory substitute for simulated altitude testing as it would be substantially more costly, 3) there would be an inherent increase in risk associated with use of flight testing without first conducting substantial ground testing, 4) flight testing would be less preferable from an environmental perspective as exhaust products would be directly discharged into the stratosphere where releases could be more damaging, and 5) an increase in flight time would be required compared to ground testing at AEDC, as more information could be gathered during ground testing. Relative to the subsequently promulgated Title 32, Part 989.8(b), this alternative would not meet the definition of a òeasonable alternative, defined as one that meets ôhe underlying purpose and need for the proposed action and that would cause a reasonable person to inquire further before choosing a particular course of action based on the rationale set forth in the 1977 Formal EA screening. This alternative would also be highly speculative because it would require an õnlikely change in law or governmental policy [Title 32 989.8(b)]. US government law and policy support the development of advanced technologies that enhance military superiority, and do not favor practices that unnecessarily risk human life in experimentation and testing. As an update to the 1977 Formal EA, the current EIAP effort for AEDC mission testing builds upon the initial screening and does not endeavor to analyze anew this range of alternatives. The proposed action for the current process, Continued Testing at AEDC with Future Upgrades and New Construction, will be compared to the No Action alternative. Title 32 Part 989.8(d) states that ÒNo Action may mean either that current management practice will not change or that the proposed action will not take place. As discussed above under the summary of the 1977 EA, Alternative a) Not conducting the tests, a no action alternative equivalent to the proposed action not taking place and tantamount to discontinuing testing at AEDC, is highly speculative under the definition found in Title 32 Part 989.8(b) and does not warrant detailed analysis. The No Action alternative for the current analysis consists of continuation of current testing capabilities. Under the No Action alternative, current testing operations would continue but there would no significant future upgrades or new construction to advance the development and use of new technologies or acquisition of new systems. Testing of newly acquired systems could be conducted, but only those accommodated largely by existing facilities; only routine maintenance and repairs would be conducted and relatively minor upgrades implemented to support continued operations. As under the proposed action, testing functions would be consolidated as appropriate to gain efficiencies and respond to a reduction in the overall level of operation at AEDC, consistent with the òight size principles of the AEDC General Plan. Facilities would become inactive as their purpose and usefulness became outdated. Under the No Action alternative, AEDC³ ability to test and use emerging technologies and acquire new systems in support of the AFMC³ mission, as well as its ability to facilitate continued compliance with PL 81-415 and governing policies regarding military superiority and national security, would diminish over time. Development of future systems and capabilities could be hampered or rendered unfeasible if new testing capabilities were not replaced elsewhere. If new ground testing capabilities were not replaced at alternate facilities, there could be an increase in the need for flight testing with an associated increase in risks and expense. The decrease in AEDC ground testing operations over time would result in a potential decrease in the associated release of pollutants to the local environment; however, there could be a concomitant increase in releases locally or at other facilities if a greater number of flight tests were conducted to offset the loss of ground testing capabilities. Under the No Action alternative, employment would be expected to remain comparable to current conditions over the near term, but then decrease over time as the level of activity at ADEC decreased.

Name:	Impact:	Status:	Description:
Air Installation Compatable:	No Effect	Closed	

Air Quality:	Unknown Effect	Closed	
Water Resources:	Unknown Effect	Closed	
Safety And Occupational Health:	No Effect	Closed	
Hazardous Materials:	No Effect	Closed	
Hazardous Waste:	No Effect	Closed	
Biological Resources:	No Effect	Closed	New construction will have to follow guides set in all pertinent laws, regulations. etc. as well as any permits that may be required to acomplish new construction.
Cultural Resources:	No Effect	Closed	New construction and modification to NRHP eligible facilities will have to follow guidelines provided in pertinent laws, regulations, and agreements.
Geology And Soils:	No Effect	Closed	
Socioeconomic:	Positive Effect	Closed	

Other Impacts:

Remarks:

Determination: Further Environmental Analysis Required

Determination Justification:

Environmental Planning Approval Signature ---- SHERRILL-PA

Comments ----

Gentlemen, This is an 813 for inclusion in the Mission EA being written by Jacobs Engineering. Please make your comments ASAP so we can get the process completed.

Environmental Final Approval Signature ---- SHERRILL-PA

Comments ----

There are no open action items associatied with this EIA since 1) an EA is required and 2) individual construction/demo/facility changes will have to be evaluated on separate EIAs.

Media Management Approval Signature ---- KING-PF

Comments ----

EIAP Approval Signature ---- MCWHITE-RW

Comments ----

APPENDIX B

Summary of NEPA Documents for Testing and Infrastructure

Document Name	Facilities Addressed	Summary of Proposed Action	Alternatives Considered	Potential Environmental Consequences	Mitigation Measures
Draft Environmental Impact Statement for Aeropropulsion System Test Facility (ASTF); 09 Nov 1976	ASTF (ETF-C)	Operation of ASTF which will accurately simulate flight environments for development, certification, and qualification of large air-breathing engines	• Testing on a Flying Test Bed Aircraft • Modification of existing facilities • Locating at other facility • No Action	• Master Plan and Land Use – No significant Impact • Water – impacts mitigated • Air – No known adverse environmental impacts • Solid Waste – no significant impacts	• Temporary controls of dust and stormwater during construction.
Formal Environmental Assessment for Arnold Engineering Development Center Operations, AAFS, Tennessee, Air Force Systems Command; 01 Feb 1977	All facilities on site	This formal Environmental Assessment is to provide NEPA documentation for the existing AEDC facilities	• Not conducting the testing • Conducting the testing at another facility • Flight testing	• Air emissions from testing propulsion systems • Air emissions from supporting equipment • Water from Woods Reservoir for industrial and domestic use • Land – use of oil as a palliative for dust control, maintenance of sanitary landfill and burial of small amounts of toxic wastes near landfill • Noise – localized high noise levels from engine testing	
Amendment to the Formal Environmental Assessment for Arnold Engineering Development Center Operations to modify facilities for the inspection, buildup, testing and decontamination of MX motors; NA	• ETF • Rocket Prep Buildings • X-ray Laboratory • J-4 and J-5	Inspection and firing of Stage II and III MX solid rocket motors and firing and decontamination of Stage IV MX liquid rocket engines.	• Not conducting the testing • Conducting the testing at another facility • Flight testing	• Air emissions from testing propulsion systems • Air emissions from supporting equipment • Water from Woods Reservoir for industrial and domestic use • Land – use of oil as a palliative for dust control, maintenance of sanitary landfill and burial of small amounts of toxic wastes near landfill • Noise – localized high noise levels from engine testing	
Amendment II to the Formal Environmental Assessment for Arnold Engineering Development Center Operations Project E41P-74, Samson IUS SRM-1 Rocket Motor Tests in Test Cell J-5; 01 Oct 1979	J-5	Testing of the large IUS rocket motors	• Burn at a site other than AEDC or another site within AEDC: burning at other sites was not considered viable as transportation would present a danger to public health. • An alternative site was considered at AEDC (fire training pit) but has less clear zone to the forest and the burn pit may contain incompatible material. • Detonation was considered inappropriate.	• Air emissions of CO at ground level exceed level covered in 1977 Environmental Assessment for 160 seconds, but hourly level is less than level in 1977 EA. • Water discharges exceed the 1977 EA concentration for hydrogen chloride. Ferrous chloride was not addressed in the 1977 EA.	

Document Name	Facilities Addressed	Summary of Proposed Action	Alternatives Considered	Potential Environmental Consequences	Mitigation Measures
Revised Environmental Assessment for Destruction Burn of MX Stage II propellant; 22 Mar 1983	Vicinity of AEDC Airfield	Open air burning of approximately 28,000 lbs of MX stage II propellant in three separate burns involving a test burn of approximately 2,000 lbs and two approximately equal subsequent burns.	• Burn at a site other than AEDC or another site within AEDC: burning at other sites was not considered viable as transportation would present a danger to public health. • An alternative site was considered at AEDC (fire training pit) but has less clear zone to the forest and the burn pit may contain incompatible material. • Detonation was considered inappropriate.	• Expected emissions per 15,000 lbs of fuel are: 5,155 lbs AL_2O_3, 2,870 lbs of HCl, and 2,966 lbs of CO. Relevant exposure limits are given. Sampling will be conducted during burn. Concentration estimates were made with the standard Gaussian dispersion equation for particulates. Results indicate appropriate standards will not be exceeded. • Impact to water quality will be minimal • No adverse impact to flora or fauna is expected	• Pits and firebreaks will be leveled and seeded over. • Personnel in path of predicted excessive HCl levels will be evacuated. • The burns will be conducted only during “safe” meteorological conditions as determined by the modeling results. • Burn pits will be sampled for hazardous characteristics and removed and properly disposed of if necessary. • Flora will be protected by conducting the burn during the winter (dormant) season.
Environmental Assessment of the Large Altitude Rocket Cell: 12 Sep 1984	• Proposed test cell • J4/J5 control bldg. • Bldg. 2215 addition • ETF-A exhauster	Construction of a large altitude rocket cell and associated infrastructure with capability to test larger rockets than existing facilities allow.	• A direct vent of exhaust gases to the atmosphere instead of prior cooling/scrubbing in the exhaust system. This was deemed infeasible because of environmental impacts. • Construct the facility elsewhere, but the existing facilities at AEDC made this option cost prohibitive. • Not to construct. Unfeasible because of the high workload expected and the need to test larger and more powerful rockets.	• Land use – less land will be available for public use. • Water – raw water use requirements from Woods Reservoir would be minor and discharges would be within NPDES limits. • Sewage – minimal • Air – minimal with treatment • Wildlife – minimal (Canada goose and Osprey). • Noise – minimal with administrative measures for close personnel. • Socioeconomic – minimal	• Reseeding cleared areas and restoration to gentle grades after construction. • Surface Water drains to retention reservoir and is tested before release: spill prevention responsibility of construction contractor. • Volume of raw water used is minor compared to normal usage; calculations for discharge to Woods Reservoir predict concentrations below NPDES limits; periodic testing o f releases from retention reservoir. • Sewage will be piped to existing system. • Contingencies if pumped water overfills retention pond are: lowering pond level, pipe to creek, or postponing testing. • Fugitive dust controlled by wetting traffic areas.

Document Name	Facilities Addressed	Summary of Proposed Action	Alternatives Considered	Potential Environmental Consequences	Mitigation Measures
Environmental Assessment of the Large Altitude Rocket Cell: 12 Sep 1984 (continued)					• Alternative placement of a hacking pair of osprey if necessary. • Hearing protection during construction, excluding personnel from defined areas during testing. • Al2O3 and HCl will be removed by exhaust cooling water; CO calculations show no adverse impact, but if necessary mitigation measures include postponing tests, evacuating personnel, or increasing stack height.
Environmental Assessment for Expanded Flow Arc Heaters: N/A	High Temperature Lab (HTL)	Fabricate and install an Expanded Flow Arc Heater to use in simulations of atmospheric re-entry. Includes modifications to the HTL building.	• Constructing a new exhauster plant (with steam injector) or using an air ejector instead of the existing exhauster plant. • Spray cooling before the exhaust reached the existing ducting of exhaust machinery. • Location other than AEDC would be prohibitive because of construction. • Not construct	Construction Phase: • Air – Minimal dust and construction equipment exhaust. • Socioeconomic – Minimal local beneficial impact Operation Phase: • Raw Water – No unusual demand on supply system. No adverse contamination or temperature. • Air – Some NOx plus small amounts of N2O, O3, CO, CO2, and copper. Less than 2.07 tons/yr of NOx under Permit 996351P. Amounts are too small to trigger PSD regulations. Plume dispersion calculations show concentrations below STEL values for O3, CO, and CO2. No STEL exists forN2O. Copper and suspended particulate concentrations less than STEL. Rosite (4% asbestos) creates 0.0023 fibers/cm^3 which is well below the OSHA PEL of 0.2 fibers/ cm^3.	• Personnel will be in the control room with ear protection during testing. • Ductwork will be periodically sampled for asbestos and asbestos removed if necessary. • Large volume water spray system exists to scrub the air prior to exhausting. • Stack height can be increased. • Tests postponed if adverse conditions are expected.

Document Name	Facilities Addressed	Summary of Proposed Action	Alternatives Considered	Potential Environmental Consequences	Mitigation Measures
Final EA and FONSI, DECADE Simulator Facility, AEDC, Arnold AFB, TN. U.S. Army Corps of Engineers, Mobile District, Mobile, Alabama: March 1991.	DECADE Simulator Facility	Construct a facility to produce high-output X-ray for testing of materials under nuclear weapons effects to assess survivability.	• Use or expansion of existing X-ray test facilities • Alternative AEDC sites. • Not construct	• Soil – 2.5 acres of disturbance. • Groundwater – existing contaminated groundwater flows away from facility. • Surface Water – Stormwater flow. Spill potential • Air – Dust from excavation and heavy equipment operation. • Socioeconomic – Approximately $60M local beneficial impact	• Erosion control measures implemented. • Fugitive dust controlled by wetting traffic areas and covering loads.
Environmental Assessment for the Construction, Alteration, and Operation of Engine Test Cells Transferred from NAWC Trenton, NJ to AAFB. Prepared for AF Materiel Command by Southern Division, Naval Facilities Engineering Command. (94-5280-9]; 01 May 1995	New Construction	Two concrete foundation pads and utility services construction to accommodate two prefab T-9 engine test cells and associated noise suppressor systems. Building 878 would be modified to accommodate testing of small engines.	• Construction of a new building instead of modifying 878. • Five locations considered at AEDC for the T-9 test cells. • No Action	• Physiology, topography, and soils – minimal grading. • Surface Water – soil erosion, increased wastewater, increased runoff from impermeable areas. • Groundwater – potential contamination from spills. • Air – Air emissions of 0.15 tons/yr CO and 0.88 tons/yr nitrogen oxides at Building 878; 65 tons/yr nitrogen oxides, 45 tons/yr CO, 5 tons/yr particulates, 2.9 tons/yr SO2 at T-9 facility. • Hazardous Waste – minor generation of oil or solvents. • Vegetation – approximately 3 acres of vegetation removed.	• Erosion control during construction as required by regulations; direct runoff to stormwater management system. • Air quality Prevention of Significant Deterioration (PSD) review including modeling. • Disposal of hazardous waste in accordance with existing Hazardous Waste Management Plan. • Replace vegetation with lawn grasses.

APPENDIX C

NPDES Permits

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
401 CHURCH STREET
L & C ANNEX 6TH FLOOR
NASHVILLE TN 37243-1534

April 12, 2005

Mr. Frank Duncan
Deputy Chief, Environmental Management Division
Arnold Engineering Development Center
100 Kendell Drive, Suite A228
Arnold AFB, TN 37389

Subject: **Modified NPDES Permit No. TN0003751**
Arnold Engineering Development Center
Tullahoma, Franklin County, Tennessee

Dear Mr. Duncan:

In accordance with the provisions of "The Tennessee Water Quality Control Act" (Tennessee Code Annotated, Sections 69-3-101 through 69-3-120) your NPDES Permit is hereby modified by the Division of Water Pollution Control. The continuance and/or reissuance of this NPDES Permit is contingent upon your meeting the conditions and requirements as stated therein.

You have the right to appeal any of the provisions established in this NPDES Permit, in accordance with Tennessee Code Annotated, Section 69-3-110, and the General Regulations of the Tennessee Water Quality Control Board. If you elect to appeal, you should file a petition within thirty (30) days of the receipt of this permit.

If you have questions, please contact the Division of Water Pollution Control at your local Environmental Assistance Center at 1-888-891-TDEC; or, at this office, please contact Mr. Vojin Janjic at (615) 532-0670 or by E-mail at *Vojin.Janjic@state.tn.us*.

Sincerely,

Edward M. Polk, Jr.

Edward M. Polk, Jr., P.E.
Manager, Permit Section
Division of Water Pollution Control

EMP/VMJ
Enclosure

cc: Division of Water Pollution Control, Permit Section
Division of Water Pollution Control, Environmental Assistance Center - Columbia
Ms. Connie A. Kagey, EPA Region IV, Sam Nunn Atlanta Federal Center, NPDES Permit Section, 61 Forsyth Street SW, Atlanta, GA 30303-3104

STATE OF TENNESSEE

NPDES PERMIT

No. TN0003751 (Modified)

Authorization to discharge under the
National Pollutant Discharge Elimination System (NPDES)

Issued By

Tennessee Department of Environment and Conservation
Division of Water Pollution Control
401 Church Street, 6th Floor, L & C Annex
Nashville, Tennessee 37243-1534

Under authority of the Tennessee Water Quality Control Act of 1977 (T.C.A. 69-3-101 et seq.) and the delegation of authority from the United States Environmental Protection Agency under the Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977 (33 U.S.C. 1251, et seq.)

Discharger: **Arnold Engineering Development Center**

is authorized to discharge: **treated process wastewater, non-process wastewater, sanitary wastewater, remediated groundwater and storm water runoff from Outfall 001; process wastewater, non-process wastewater, remediated groundwater, and storm water runoff from Outfall SW2; process wastewater, non-process wastewater and storm water runoff from SW3 (incl. Outfall 005); non-process wastewater during scheduled maintenance activities that require shutdown of the pumping station and system malfunctions from Outfalls 002 and 003; treated sanitary wastewater from Outfall 004; steam plant condensate and reverse osmosis wastewater, process wastewater, noncontact cooling water and storm water runoff from Outfall 005; treated groundwater from Outfall 006; nonprocess wastewater, building groundwater drainage, and non-industrial storm water from Outfall 007; and noncontact cooling water and non-industrial storm water from Outfall 008**

from a facility located: **in Arnold Air Force Base, Coffee and Franklin Counties, Tennessee**

to receiving waters named: **unnamed tributary to Rowland Creek (001); unnamed tributary to Bradley Creek (002, SW2 & 007); unnamed tributary to Brumalow Creek (003, SW3 & 005); unnamed tributary to Spring Creek (006); and Woods Reservoir (004 & 008)**

in accordance with effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective on: **April 11, 2005**

This permit shall expire on: **May 31, 2007**

Issuance date: **April 8, 2005**

Edward M. Polk
for Paul E. Davis, Director
Division of Water Pollution Control

CN-0759

RDAs 2352 and 2366

TABLE OF CONTENTS

Page

PART I

PART II

PART III

PART IV

STORM WATER POLLUTION PREVENTION PLAN

SECOND ADDENDUM TO RATIONALE

ADDENDUM TO RATIONALE

RATIONALE

APPENDIX

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

Arnold Engineering Development Center is authorized to discharge treated process wastewater, non-process wastewater, sanitary wastewater, remediated groundwater and storm water runoff from Outfall 001; process wastewater, non-process wastewater, remediated groundwater, and storm water runoff from Outfall SW2; process wastewater, non-process wastewater and storm water runoff from SW3 (incl. Outfall 005); non-process wastewater during scheduled maintenance activities that require shutdown of the pumping station and system malfunctions from Outfalls 002 and 003; treated sanitary wastewater from Outfall 004; steam plant condensate and reverse osmosis wastewater, process wastewater, noncontact cooling water and storm water runoff from Outfall 005; treated groundwater from Outfall 006; nonprocess wastewater, building groundwater drainage, and non-industrial storm water from Outfall 007; and noncontact cooling water and non-industrial storm water from Outfall 008 to unnamed tributary to Rowland Creek (001); unnamed tributary to Bradley Creek (SW2 & 007); unnamed tributary to Brumalow Creek (SW3 & 005); unnamed tributary to Spring Creek (006); and Woods Reservoir (004 & 008).These discharges shall be limited and monitored by the permittee as specified below:

PERMIT LIMITS

Outfall 001
Process, Nonprocess and Sanitary Wastewater, Remediated Groundwater and Storm Water Runoff

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	Report (MGD) (1)		Report (MGD) (1)		Continuous	Recorder
pH (2)	Range 6.5 - 9.0				Continuous	Recorder
CBOD5	15.0	--	25.0	--	1/Week	Composite
NITROGEN, AMMONIA TOTAL	1.1	--	2.2	--	1/Week	Composite
DISSOLVED OXYGEN (D.O.)	6.0 mg/l minimum				1/Week	Grab
TSS (Influent) (3)	Report	--	Report	--	1/Month	Composite
TDS (Influent) (3)	Report	--	Report	--	1/Month	Composite
TSS (Effluent)	Report	--	Report	--	1/Month	Composite
TDS (Effluent)	Report	--	Report	--	1/Month	Composite
Oil & Grease	10.0	--	15.0	--	1/Month	Grab
COPPER, Total	0.03	--	0.04	--	1/Month	Composite
CADMIUM, Total	0.003	--	0.005	--	1/Week	Composite
CHROMIUM, Total	0.10	--	0.20	--	1/Month	Composite
LEAD, Total	0.01	--	0.10	--	1/Week	Composite
SILVER, Total	--	--	0.003	--	1/Month	Composite
CHLORINE, TOTAL RESIDUAL (TRC)	0.011 (5)	--	0.019 (5)	--	1/Week	Grab
TEMPERATURE, Effluent	Report effluent temperature (° C)				Continuous	Recorder
IC25	Survival, Reproduction, & Growth in 100% Effluent				Semi-annual	Composite (6)

(1) Flow shall be reported in Million Gallons per Day (MGD).
(2) Analyses shall be performed within 15 minutes following sample collection.
(3) The sample shall be representative of the intake water from Woods Reservoir.
(4) Sampling for total silver will be removed if, after the first year of sampling, the concentrations are always below the RDL (0.001 mg/L). If total silver is detected in any of the Outfall 001 samples, monitoring will be continued for the term of the permit on a monthly basis.
(5) The acceptable methods for detection of total residual chlorine are any methods specified in 40 CFR Part 136 that reach a detection level allowing accurate evaluation of compliance with the permit limits. The required analytical quantitation level for TRC is the permit limit or 0.05 mg/L, whichever is lower. In cases where there appears to be matrix interferences, and the permit limit is less than 0.05, the permittee may use 0.05 mg/L as the analytical quantitation level that shall be used for compliance evaluations. A quantitation level other than 0.05 mg/L may be appropriate, but the permittee will not be approved to use it without supporting data for the wastewater in question. A request to use >0.05 mg/L or an alternate compliance evaluation detection level must be submitted to the regional TN Environmental Assistance Center and to the Enforcement and Compliance Section.

(6) See Part III for methodology.

PERMIT LIMITS

Outfall 004
Arnold Village STP

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS MONTHLY AVG. CONC. (mg/l)	MONTHLY AVG. AMNT. (lb/day)	DAILY MAX. CONC. (mg/l)	DAILY MAX. AMNT. (lb/day)	MONITORING REQUIREMENTS MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	Report (MGD) *		Report (MGD) *		5/Week	Instantaneous
pH **	Range 6.0 - 9.0				5/Week	Grab
BOD5	30	--	45	--	2/Month	Composite
NITROGEN, AMMONIA TOTAL	5.0	--	8.0	--	2/Month	Composite
TOTAL SUSPENDED SOLIDS (TSS)	30	--	45	--	2/Month	Composite
E. Coli ***	126/100 mL	--	941/100 mL	--	3/Week	Grab
DISSOLVED OXYGEN (D.O.)	1.0 mg/l minimum				5/Week	Grab
CHLORINE, TOTAL RESIDUAL (TRC)	--	--	0.5	--	2/Week	Grab
SOLIDS, SETTLEABLE	--	--	1.0 mL/L	--	2/Week	Grab

* Flow shall be reported in Million Gallons per Day (MGD)

** pH analyses shall be performed within 15 minutes following sample collection.

*** The wastewater discharge must be disinfected to the extent that viable coliform organisms are effectively eliminated. The E. coli concentration shall not exceed 126 per 100 ml as the geometric mean based on a minimum of 10 samples, collected from a given sampling site over a period of not more than 30 consecutive days with individual samples being collected at intervals of not less than 12 hours. For the purpose of determining the geometric mean, individual samples having a fecal coliform or E. coli group concentration of less than one (1) per 100 ml shall be considered as having a concentration of one (1) per 100 ml. In addition, the concentration of the E. coli group in any individual sample shall not exceed 941 per 100 ml. In the absence of a method in 40 CFR, Part 136 for measuring E. coli in effluent matrices, the permittee shall use methods proposed or added to Part 136 for measuring E. coli in ambient water.

PERMIT LIMITS

<u>Outfall SW2 and SW3 - Wet Weather Discharges</u>

Outfalls SW 2 and SW3 discharge only to response to exceptionally large storm events that exceed the pumping station capacity.

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS MONTHLY AVG. CONC. (mg/l)	MONTHLY AVG. AMNT. (lb/day)	DAILY MAX. CONC. (mg/l)	DAILY MAX. AMNT. (lb/day)	MONITORING REQUIREMENTS MSRMNT. FRQNCY.	SAMPLE TYPE *
FLOW	--	--	Report (MGD) **		Semi-annual	Recorder
pH ***	Report				Semi-annual	Grab
BOD5	--	--	Report	--	Semi-annual	Grab
COD	--	--	Report	--	Semi-annual	Grab
TOTAL SUSPENDED SOLIDS (TSS)	--	--	Report	--	Semi-annual	Grab
OIL & GREASE	--	--	Report	--	Semi-annual	Grab

* Sample collected during a Qualifying Storm Event.

** Flow shall be reported in Million Gallons per Day (MGD)

*** pH analyses shall be performed within 15 minutes following sample collection.

PERMIT LIMITS

Internal Monitoring Point 01A
Main Sewage Treatment Plant Effluent

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	Report (MGD) *		Report (MGD) *		Continuous	Recorder
pH **	Range 6.0 - 9.0				5/Week	Grab
BOD5	30	--	45	--	3/Week	Composite
TOTAL SUSPENDED SOLIDS (TSS)	30	--	45	--	3/Week	Composite
E. Coli ***	126/100 mL	--	941/100 mL	--	3/Week	Grab
SOLIDS, SETTLEABLE	--	--	1.0 mL/L	--	5/Week	Grab

* Flow shall be reported in Million Gallons per Day (MGD)

** pH analyses shall be performed within 15 minutes following sample collection.

*** The wastewater discharge must be disinfected to the extent that viable coliform organisms are effectively eliminated. The E. coli concentration shall not exceed 126 per 100 ml as the geometric mean based on a minimum of 10 samples, collected from a given sampling site over a period of not more than 30 consecutive days with individual samples being collected at intervals of not less than 12 hours. For the purpose of determining the geometric mean, individual samples having a fecal coliform or E. coli group concentration of less than one (1) per 100 ml shall be considered as having a concentration of one (1) per 100 ml. In addition, the concentration of the E. coli group in any individual sample shall not exceed 941 per 100 ml. In the absence of a method in 40 CFR, Part 136 for measuring E. coli in effluent matrices, the permittee shall use methods proposed or added to Part 136 for measuring E. coli in ambient water.

PERMIT LIMITS

Internal Monitoring Point 01B (to Outfall 001)
Treated Groundwater - ASTF

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	--	--	Report (MGD) *		1/Quarter	Estimate
pH **	Report				1/Quarter	Grab
TRICHLORETHENE	--	--	Report	--	1/Quarter	Grab

* Flow shall be reported in Million Gallons per Day (MGD)

** pH analyses shall be performed within 15 minutes following sample collection.

PERMIT LIMITS

Internal Monitoring Point 01C (to Outfall 001)
Site 1 Remediated Groundwater

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	--	--	Report (MGD) *		1/Quarter	Estimate
pH **	Report				1/Quarter	Grab
1,1-DICHLOROETHENE	--	--	Report	--	1/Quarter	Grab
1,1,1-TRICHLOROETHANE	--	--	Report	--	1/Quarter	Grab
TRICHLORETHENE	--	--	Report	--	1/Quarter	Grab
TETRACHLOROETHENE	--	--	Report	--	1/Quarter	Grab

* Flow shall be reported in Million Gallons per Day (MGD)
** pH analyses shall be performed within 15 minutes following sample collection.

PERMIT LIMITS

Internal Monitoring Point 01D (to Outfall 001)
Site 22 Remediated Groundwater

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	--	--	Report (MGD) *		1/Quarter	Estimate
pH **	Report				1/Quarter	Grab
1,1-DICHLOROETHENE	--	--	Report	--	1/Quarter	Grab
1,1,1-TRICHLOROETHANE	--	--	Report	--	1/Quarter	Grab
TRICHLORETHENE	--	--	Report	--	1/Quarter	Grab
TETRACHLOROETHENE	--	--	Report	--	1/Quarter	Grab

* Flow shall be reported in Million Gallons per Day (MGD)
** pH analyses shall be performed within 15 minutes following sample collection.

PERMIT LIMITS

Internal Monitoring Point 01E (to Outfall 001)
AC&T Site Remediated Groundwater

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	--	--	Report (MGD) *		1/Quarter	Estimate
pH **	Report				1/Quarter	Grab
1,1-DICHLOROETHENE	--	--	Report	--	1/Quarter	Grab
1,1,1-TRICHLOROETHANE	--	--	Report	--	1/Quarter	Grab
TRICHLORETHENE	--	--	Report	--	1/Quarter	Grab
TETRACHLOROETHENE	--	--	Report	--	1/Quarter	Grab

* Flow shall be reported in Million Gallons per Day (MGD)
** pH analyses shall be performed within 15 minutes following sample collection.

PERMIT LIMITS

Internal Monitoring Point 02A (to Outfall 001)
Site 8 Remediated Groundwater

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS MONTHLY AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	DAILY MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MONITORING REQUIREMENTS MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	Report (MGD) *		Report (MGD) *		1/Quarter	Estimate
pH **	Report				1/Quarter	Grab
1,1,1-TRICHLOROETHANE	--	--	Report	--	1/Quarter	Grab
TETRACHLOROETHENE	--	--	Report	--	1/Quarter	Grab

* Flow shall be reported in Million Gallons per Day (MGD)
** pH analyses shall be performed within 15 minutes following sample collection.

PERMIT LIMITS

Outfall 005
Steam Plant Condensate and Steam Plant Reverse Osmosis Wastewater,
Noncontact Cooling Water, Groundwater Drainage

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS MONTHLY AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	DAILY MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MONITORING REQUIREMENTS MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	--	--	Report (MGD) *		1/Month	Estimate
pH **	Range 6.5 - 9.0				1/Month	Grab
OIL & GREASE	--	--	Report	--	1/Quarter	Grab
TEMPERATURE, Effluent	Report effluent temperature (°C)				1/Month	Grab

* Flow shall be reported in Million Gallons per Day (MGD)
** pH analyses shall be performed within 15 minutes following sample collection.

PERMIT LIMITS

Outfall 006
Site 6 Remediated Groundwater

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS MONTHLY AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	DAILY MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MONITORING REQUIREMENTS MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	Report (MGD) *		Report (MGD) *		1/Quarter	Estimate
pH **	Range 6.5 - 9.0				1/Quarter	Grab
1,1-DICHLOROETHENE	--	--	0.005	--	1/Quarter	Grab
METHYLENE CHLORIDE	--	--	0.025	--	1/Quarter	Grab

* Flow shall be reported in Million Gallons per Day (MGD)
** pH analyses shall be performed within 15 minutes following sample collection.

PERMIT LIMITS

Outfall 007
Building HVAC Discharge, Building Groundwater Drainage, Non-Industrial Storm Water

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	--	--	Report (MGD) *		1/Month	Estimate
pH **	Range 6.5 - 9.0				1/Month	Grab

* Flow shall be reported in Million Gallons per Day (MGD)
** pH analyses shall be performed within 15 minutes following sample collection.

PERMIT LIMITS

Outfall 008
Noncontact Cooling Water, Non-Industrial Storm Water

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	--	--	Report (MGD) *		1/Quarter	Estimate
pH **	Range 6.0 - 9.0				1/Quarter	Grab
TEMPERATURE, Effluent	Report effluent temperature (°C)				1/Quarter	Grab

* Flow shall be reported in Million Gallons per Day (MGD)
** pH analyses shall be performed within 15 minutes following sample collection.

PERMIT LIMITS

Dry Weather Discharges - Outfalls 002 and 003
Discharge during scheduled maintenance activities that require shutdown of the pumping station and system malfunctions.

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY. ***	SAMPLE TYPE *
FLOW	--	--	Report (MGD) **		1/Discharge	Instantaneous
pH **	Range 6.5 to 9.0				1/Discharge	Grab
TEMPERATURE, Effluent	Report effluent temperature (°C)				1/Discharge	Grab
COD	--	--	Report	--	1/Discharge	Grab
TOTAL SUSPENDED SOLIDS (TSS)	--	--	40	--	1/Discharge	Grab
OIL & GREASE	--	--	15	--	1/Discharge	Grab

* Flow shall be reported in Million Gallons per Day (MGD)
** pH analyses shall be performed within 15 minutes following sample collection.
*** Once per discharge or once per week, whichever is less frequent.

Additional monitoring requirements and conditions applicable to all outfalls include:

There shall be no distinctly visible floating scum, oil or other matter contained in the wastewater discharge. The wastewater discharge must not cause an objectionable color contrast in the receiving stream.

The wastewater discharge shall not contain pollutants in quantities that will be hazardous or otherwise detrimental to humans, livestock, wildlife, plant life, or fish and aquatic life in the receiving stream.

Sludge or any other material removed by any treatment works must be disposed of in a manner which prevents its entrance into or pollution of any surface or subsurface waters. Additionally, the disposal of such sludge or other material must be in compliance with the Tennessee Solid Waste Disposal Act, TCA 68-31-101 et seq. and the Tennessee Hazardous Waste Management Act, TCA 68-46-101 et seq.

B. MONITORING PROCEDURES

1. Representative Sampling

Samples and measurements taken in compliance with the monitoring requirements specified herein shall be representative of the volume and nature of the monitored discharge, and shall be taken after treatment and prior to mixing with uncontaminated storm water runoff or the receiving stream.

2. Sampling Frequency

If there is a discharge from a permitted outfall on any given day during the monitoring period, the permittee must sample and report the results of analyses accordingly, and the permittee should not mark the 'No Discharge' box on the Discharge Monitoring Report form.

3. Test Procedures

a. Test procedures for the analysis of pollutants shall conform to regulations published pursuant to Section 304 (h) of the Clean Water Act (the "Act"), as amended, under which such procedures may be required.

b. Unless otherwise noted in the permit, all pollutant parameters shall be determined according to methods prescribed in Title 40, CFR, Part 136, as amended, promulgated pursuant to Section 304 (h) of the Act.

c. Test Method for E. Coli

Because 40 CFR Part 136 does not include test methods for measuring E. coli in effluent matrices, the Division has added a notation on the limits table page requiring the use of the methods either proposed or added by the EPA to Part 136 for measuring E. coli in ambient waters.

The Division has no basis to believe that the proposed methods for ambient waters are inappropriate on treated effluent. The Division prefers measurement of the E. coli in treated effluent to the measurement of the ambient E. coli up and downstream of the outfall. Comparison of ambient monitoring data fails to conclusively characterize a wastewater effluent. Additionally, meaningful comparison of E. coli in the treated effluent to E. coli in receiving stream needs to use the same test method. Sampling the effluent using ambient test methods characterizes effluent in terms that are comparable to future assessments of ambient pathogens.

4. Recording of Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

a. The exact place, date and time of sampling;

b. The exact person(s) collecting samples;

c. The dates and times the analyses were performed;

d. The person(s) or laboratory who performed the analyses;

e. The analytical techniques or methods used, and;

f. The results of all required analyses.

5. Records Retention

All records and information resulting from the monitoring activities required by this permit including all records of analyses performed and calibration and maintenance of instrumentation shall be retained for a minimum of three (3) years, or longer, if requested by the Division of Water Pollution Control.

C. DEFINITIONS

The ***Daily Maximum Concentration*** is a limitation on the average concentration, in milligrams per liter (mg/L), of the discharge during any calendar day. When a proportional-to-flow composite sampling device is used, the daily concentration is the concentration of that 24-hour composite; when other sampling means are used, the daily concentration is the arithmetic mean of the concentrations of equal volume samples collected during any calendar day or sampling period.

The ***Monthly Average Concentration***, a limitation on the discharge concentration, in milligrams per liter (mg/L), is the arithmetic mean of all daily concentrations determined in a one-month period. For the purpose of this definition, a frequency of 2/Month is representative of 2 separate daily samples, each sample having been collected on a separate day during the monitoring period.

The ***Monthly Average Amount***, a discharge limitation measured in pounds per day (lb/day), is the total amount of any pollutant in the discharge by weight during a calendar month divided by the number of days in the month that the production or commercial facility was operating. Where less than daily sampling is required by a permit, the monthly average amount shall be determined by the summation of all the measured daily discharges by weight divided by the number of days during the calendar month when the measurements were made. For the purpose of this definition, a frequency of 2/Month is representative of 2 separate daily samples, each sample having been collected on a separate day during the monitoring period.

The ***Daily Maximum Amount***, is a limitation measured in pounds per day (lb/day), on the total amount of any pollutant in the discharge by weight during any calendar day.

The ***Instantaneous Concentration*** is a limitation on the concentration, in milligrams per liter (mg/L), of any pollutant contained in the discharge determined from a grab sample taken at any point in time.

A ***Composite Sample***, for the purposes of this permit, is a sample collected continuously over a period of 24-hours at a rate proportional to the flow. Composite sample should be a combination of at least 8 sample aliquots of at least 100 milliliters, collected at periodic intervals during the operating hours of a facility over a 24-hour period.

For the purposes of this permit, a ***Composite Sample*** for non-storm water discharges is a sample collected continuously over a period of 24-hours at a rate proportional to the flow.

For the purposes of this permit, a **Composite Sample** for non-storm water discharges is a composite sample of at least 24 grab samples collected at regular intervals over a period of 24-hours.

A ***Grab Sample***, for the purposes of this permit, is defined as a single effluent sample of at least 100 milliliters collected at a randomly selected time over a period not exceeding 15 minutes. The sample(s) shall be collected at the period(s) most representative of the total discharge.

For the purpose of this permit, a ***Calendar Day*** is defined as any 24-hour period.

For the purpose of this permit, a ***Quarter*** is defined as any one of the following three month periods: January 1 through March 31, April 1 through June 30, July 1 through September 30, or October 1 through December 31.

For the purpose of this permit, ***Semi-annually*** means the same as "once every six months." Measurements of the effluent characteristics concentrations may be made anytime during a 6 month period beginning from the issuance date of this permit so long as the second set of measurements for a given 12 month period are made approximately 6 months subsequent to that time, if feasible.

For the purpose of this permit, ***Annually*** is defined as a monitoring frequency of once every twelve (12) months beginning with the date of issuance of this permit so long as the following set of measurements for a given 12 month period are made approximately 12 months subsequent to that time.

Dry Weather Flow shall be construed to represent discharges consisting of process and/or non-process wastewater only.

Wet Weather Flow shall be construed to represent storm water runoff which, in combination with all process and/or non-process wastewater discharges, as applicable, is discharged during a qualifying storm event.

A **Qualifying Storm Event** is one which is greater than 0.1 inches and that occurs after a period of at least 72 hours after any previous storm event with rainfall of 0.1 inches or greater.

D. REPORTING

1. Monitoring Results

Monitoring results shall be recorded monthly and submitted monthly using Discharge Monitoring Report (DMR) forms supplied by the Division of Water Pollution Control. Submittals shall be postmarked no later than 15 days after the completion of the reporting period. The top two copies of each report are to be submitted. A copy should be retained for the permittee's files. DMRs and any communication regarding compliance with the conditions of this permit must be sent to:

TENNESSEE DEPT. OF ENVIRONMENT & CONSERVATION
DIVISION OF WATER POLLUTION CONTROL
COMPLIANCE REVIEW SECTION
401 CHURCH STREET
L & C ANNEX 6TH FLOOR
NASHVILLE TN 37243-1534

The first DMR is due on the fifteenth of the month following permit effectiveness.

DMRs and any other information or report must be signed and certified by a responsible corporate officer as defined in 40 CFR 122.22, a general partner or proprietor, or a principal municipal executive officer or ranking elected official, or his duly authorized representative. Such authorization must be submitted in writing and must explain the duties and responsibilities of the authorized representative.

The electronic submission of DMRs will be accepted only if approved in writing by the Division. For purposes of determining compliance with this permit, data submitted in electronic format will carry the same weight as data submitted on signed and certified DMR forms.

2. Additional Monitoring by Permittee

If the permittee monitors any pollutant specifically limited by this permit more frequently than required at the location(s) designated, using approved analytical methods as specified herein, the results of such monitoring shall be included in the calculation and reporting of the values required in the DMR form. Such increased frequency shall also be indicated on the form.

3. Falsifying Results and/or Reports

Knowingly making any false statement on any report required by this permit or falsifying any result may result in the imposition of criminal penalties as provided for in Section 309 of the Federal Water Pollution Control Act, as amended, and in Section 69-3-115 of the Tennessee Water Quality Control Act.

E. SCHEDULE OF COMPLIANCE

Full compliance and operational levels shall be attained from the effective date of this permit.

PART II

A. GENERAL PROVISIONS

1. Duty to Reapply

Permittee is not authorized to discharge after the expiration date of this permit. In order to receive authorization to discharge beyond the expiration date, the permittee shall submit such information and forms as are required to the Director of Water Pollution Control (the "Director") no later than 180 days prior to the expiration date. Such applications must be properly signed and certified.

2. Right of Entry

The permittee shall allow the Director, the Regional Administrator of the U.S. Environmental Protection Agency, or their authorized representatives, upon the presentation of credentials:

a. To enter upon the permittee's premises where an effluent source is located or where records are required to be kept under the terms and conditions of this permit, and at reasonable times to copy these records;

b. To inspect at reasonable times any monitoring equipment or method or any collection, treatment, pollution management, or discharge facilities required under this permit; and

c. To sample at reasonable times any discharge of pollutants.

3. Availability of Reports

Except for data determined to be confidential under Section 308 of the Federal Water Pollution Control Act, as amended, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Division of Water Pollution Control. As required by the Federal Act, effluent data shall not be considered confidential.

4. Proper Operation and Maintenance

a. The permittee shall at all times properly operate and maintain all facilities and systems (and related appurtenances) for collection and treatment which are installed or used by the permittee to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance also includes adequate laboratory and process controls and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit. Backup continuous pH and flow monitoring equipment are not required.

b. Dilution water shall not be added to comply with effluent requirements to achieve BCT, BPT, BAT and or other technology-based effluent limitations such as those in State of Tennessee Rule 1200-4-5-.03.

5. Treatment Facility Failure

The permittee, in order to maintain compliance with this permit, shall control production, all discharges, or both, upon reduction, loss, or failure of the treatment facility, until the facility is restored or an alternative method of treatment is provided. This requirement applies in such situations as the reduction, loss, or failure of the primary source of power.

6. Property Rights

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State, or local laws or regulations.

7. Severability

The provisions of this permit are severable. If any provision of this permit due to any circumstance, is held invalid, then the application of such provision to other circumstances and to the remainder of this permit shall not be affected thereby.

8. Other Information

If the permittee becomes aware that he failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Director, then he shall promptly submit such facts or information.

B. CHANGES AFFECTING THE PERMIT

1. Planned Changes

The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when:

a. The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source in 40 CFR 122.29(b); or

b. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations in the permit, nor to notification requirements under 40 CFR 122.42(a)(1).

2. Permit Modification, Revocation, or Termination

a. This permit may be modified, revoked and reissued, or terminated for cause as described in 40 CFR 122.62 and 122.64, Federal Register, Volume 49, No. 188 (Wednesday, September 26, 1984), as amended.

b. The permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.

c. If any applicable effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established for any toxic pollutant under Section 307(a) of the Federal Water Pollution Control Act, as amended, the Director shall modify or revoke and reissue the permit to conform to the prohibition or to the effluent standard, providing that the effluent standard is more stringent than the limitation in the permit on the toxic pollutant. The permittee shall comply with these effluent standards or prohibitions within the time provided in the regulations that establish these standards or prohibitions, even if the permit has not yet been modified or revoked and reissued to incorporate the requirement.

d. The filing of a request by the permittee for a modification, revocation, reissuance, termination, or notification of planned changes or anticipated noncompliance does not halt any permit condition.

3. Change of Ownership

This permit may be transferred to another party (provided there are neither modifications to the facility or it's operations, nor any other changes which might affect the permit limits and conditions contained in the permit) by the permittee if:

a. The permittee notifies the Director of the proposed transfer at least 30 days in advance of the proposed transfer date;

b. The notice includes a written agreement between the existing and new permittees containing a specified date for transfer of permit responsibility, coverage, and liability between them; and

c. The Director, within 30 days, does not notify the current permittee and the new permittee of his intent to modify, revoke or reissue, or terminate the permit and to require that a new application be filed rather than agreeing to the transfer of the permit.

Pursuant to the requirements of 40 CFR 122.61, concerning transfer of ownership, the permittee must provide the following information to the Division in their formal notice of intent to transfer ownership: 1) the NPDES permit number of the subject permit; 2) the effective date of the proposed transfer; 3) the name and address of the transferor; 4) the name and address of the transferee; 5) the names of the responsible parties for both the transferor and transferee; 6) a statement that the transferee assumes responsibility for the subject NPDES permit; 7) a statement that the transferor relinquishes responsibility for the subject NPDES permit; 8) the signatures of the responsible parties for both the transferor and transferee pursuant to the requirements of 40 CFR 122.22(a), "Signatories to permit applications"; and, 9) a statement regarding any proposed modifications to the facility, it's operations, or any other changes which might affect the permit limits and conditions contained in the permit.

4. Change of Mailing Address

The permittee shall promptly provide to the Director written notice of any change of mailing address. In the absence of such notice the original address of the permittee will be assumed to be correct.

C. NONCOMPLIANCE

1. Effect of Noncompliance

All discharges shall be consistent with the terms and conditions of this permit. Any permit noncompliance constitutes a violation of applicable State and Federal laws and is grounds for enforcement action, permit termination, permit modification, or denial of permit reissuance.

2. Reporting of Noncompliance

a. 24-Hour Reporting

In the case of any noncompliance which could cause a threat to public drinking supplies, or any other discharge which could constitute a threat to human health or the environment, the required notice of non-compliance shall be provided to the Division of Water Pollution Control in the appropriate Environmental Assistance Center within 24-hours from the time the permittee becomes aware of the circumstances. (The Environmental Assistance Center should be contacted for names and phone numbers of environmental response personnel).

A written submission must be provided within five days of the time the permittee becomes aware of the circumstances unless this requirement is waived by the Director on a case-by-case basis. The permittee shall provide the Director with the following information:

i. A description of the discharge and cause of noncompliance;

ii. The period of noncompliance, including exact dates and times or, if not corrected, the anticipated time the noncompliance is expected to continue; and

iii. The steps being taken to reduce, eliminate, and prevent recurrence of the noncomplying discharge.

b. Scheduled Reporting

For instances of noncompliance which are not reported under subparagraph 2.a. above, the permittee shall report the noncompliance on the Discharge Monitoring Report. The report shall contain all information concerning the steps taken, or planned, to reduce, eliminate, and prevent recurrence of the violation and the anticipated time the violation is expected to continue.

3. Overflow

a. "***Overflow***" means the discharge to land or water of wastes from any portion of the collection, transmission, or treatment system other than through permitted outfalls.

b. Overflows are prohibited.

c. The permittee shall operate the collection system so as to avoid overflows. No new or additional flows shall be added upstream of any point in the collection system, which experiences chronic overflows (greater than 5 events per year) or would otherwise overload any portion of the system.

d. Unless there is specific enforcement action to the contrary, the permittee is relieved of this requirement after: 1) an authorized representative of the Commissioner of the Department of Environment and Conservation has approved an engineering report and construction plans and specifications prepared in accordance with accepted engineering practices for correction of the problem; 2) the correction work is underway; and 3) the cumulative, peak-design, flows potentially added from new connections and line extensions upstream of any chronic bypass point are less than or proportional to the amount of inflow and infiltration removal documented upstream of that point. The inflow and infiltration reduction must be measured by the permittee using practices that are customary in the flow measurement industry and reported in an attachment to a Monthly Operating Report submitted to the local TDEC Environmental Assistance Center. The data measurement period shall be sufficient to account for seasonal rainfall patterns and seasonal groundwater table elevations.

e. In the event that more than five (5) overflows have occurred from a single point in the collection system for reasons that may not warrant the self-imposed moratorium or completion of the actions identified in this paragraph, the permittee may request a meeting with the Division of Water Pollution Control EAC staff to petition for a waiver based on mitigating evidence.

4. Upset

a. "***Upset***" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

b. An upset shall constitute an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the permittee demonstrates, through properly signed, contemporaneous operating logs, or other relevant evidence that:

i. An upset occurred and that the permittee can identify the cause(s) of the upset;

ii. The permitted facility was at the time being operated in a prudent and workman-like manner and in compliance with proper operation and maintenance procedures;

iii. The permittee submitted information required under "Reporting of Noncompliance" within 24-hours of becoming aware of the upset (if this information is provided orally, a written submission must be provided within five days); and

iv. The permittee complied with any remedial measures required under "Adverse Impact."

5. Adverse Impact

The permittee shall take all reasonable steps to minimize any adverse impact to the waters of Tennessee resulting from noncompliance with this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge. It shall not be a defense for the permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

6. Bypass

a. "***Bypass***" is the intentional diversion of wastewater away from any portion of a treatment facility. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of an overflow. Severe property damage does not mean economic loss caused by delays in production.

b. Bypasses are prohibited unless the following 3 conditions are met:

i. The bypass is unavoidable to prevent loss of life, personal injury, or severe property damage;

ii. There are not feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment down-time. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment down-time or preventative maintenance;

iii. The permittee submits notice of an unanticipated bypass to the Division of Water Pollution Control in the appropriate environmental assistance center within 24-hours of becoming aware of the bypass (if this information is provided orally, a written submission must be provided within five days). When the need for the bypass is foreseeable, prior notification shall be submitted to the Director, if possible, at least 10 days before the date of the bypass.

c. Bypasses not exceeding limitations are allowed **only** if the bypass is necessary for essential maintenance to assure efficient operation. All other bypasses are prohibited. Allowable bypasses not exceeding limitations are not subject to the reporting requirements of 6.b.iii, above.

7. Washout

a. For domestic wastewater plants only, a "washout" shall be defined as loss of Mixed Liquor Suspended Solids (MLSS) of 30.00% or more. This refers to the MLSS in the aeration basin(s) only. This does not include MLSS decrease due to solids wasting to the sludge disposal system. A washout can be caused by improper operation or from peak flows due to infiltration and inflow.

b. A washout is prohibited. If a washout occurs the permittee must report the incident to the Division of Water Pollution Control in the appropriate Environmental Assistance Center within 24-hours by telephone. A written submission must be provided within 5 days. The washout must be noted on the discharge monitoring report. Each day of a washout is a separate violation.

D. LIABILITIES

1. Civil and Criminal Liability

Except as provided in permit conditions for "**Bypassing,**" "**Overflow,**" and "**Upset,**" nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance. Notwithstanding this permit, the permittee shall remain liable for any damages sustained by the State of Tennessee, including but not limited to fish kills and losses of aquatic life and/or wildlife, as a result of the discharge of wastewater to any surface or subsurface waters. Additionally, notwithstanding this Permit, it shall be the responsibility of the permittee to conduct its wastewater treatment and/or discharge activities in a manner such that public or private nuisances or health hazards will not be created.

2. Liability Under State Law

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or the Federal Water Pollution Control Act, as amended.

PART III

OTHER REQUIREMENTS

A. TOXIC POLLUTANTS

The permittee shall notify the Division of Water Pollution Control as soon as it knows or has reason to believe:

1. That any activity has occurred or will occur which would result in the discharge on a routine or frequent basis, of any toxic substance(s) (listed at 40 CFR 122, Appendix D, Table II and III) which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

a. One hundred micrograms per liter (100 ug/l);

b. Two hundred micrograms per liter (200 ug/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 ug/l) for 2,4-dinitrophenol and for 2-methyl-4,6-dinitrophenol; and one milligram per liter (1 mg/L) for antimony;

c. Five (5) times the maximum concentration value reported for that pollutant(s) in the permit application in accordance with 122.21(g)(7); or

d. The level established by the Director in accordance with 122.44(f).

2. That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

a. Five hundred micrograms per liter (500 ug/l);

b. One milligram per liter (1 mg/L) for antimony;

c. Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with 122.21(g)(7); or

d. The level established by the Director in accordance with 122.44(f).

B. REOPENER CLAUSE

If an applicable standard or limitation is promulgated under Sections 301(b)(2)(C) and (D), 304(B)(2), and 307(a)(2) and that effluent standard or limitation is more stringent than any effluent limitation in the permit or controls a pollutant not limited in the permit, the permit shall be promptly modified or revoked and reissued to conform to that effluent standard or limitation.

Outfalls SW2 and SW3

Due to the recirculation of process wastewater, nonprocess wastewater, and storm water runoff (during small storm events), Outfalls SW2 and SW3 discharge only to response to exceptionally large storm events that exceed the pumping station capacity. It is the opinion of the division that the best method for dealing with potential pollution associated with storm water discharges from the AEDC facility is through implementation of an aggressive Storm Water Pollution Prevention Plan (SWPPP) program (reference: Permit, Part IV) coupled with discharge monitoring to verify SWPPP effectiveness. Monitoring of storm water runoff from Outfalls SW2 & SW3 will be required for Flow, pH, BOD5, COD, TSS, and Oil & Grease on a semi-annual basis. In order to assist the permittee in the evaluation of the effectiveness of the SWPPP, benchmark values developed for the Tennessee Storm Water Multi-Sector General Permit for Industrial Activities are provided herein for comparison. These benchmark values are target concentrations and should not be construed to represent permit limits. The effectiveness of this SWPPP will be investigated after the results of the storm water runoff monitoring have been submitted. At that time, should the results so dictate, the division maintains the authority to institute specific numeric limitations for the monitored parameters.

C. PLACEMENT OF SIGNS

Within sixty (60) days of the effective date of this permit, the permittee shall place and maintain a sign(s) at each outfall and any bypass/overflow point in the collection system. For the purposes of this requirement, any bypass/overflow point that has discharged five (5) or more times in the last year must be so posted. The sign(s) should be clearly visible to the public from the bank and the receiving stream or from the nearest public property/right-of-way, if applicable. The minimum sign size should be two feet by two feet (2' x 2') with one inch (1") letters. The sign should be made of durable material and have a white background with black letters.

The sign(s) are to provide notice to the public as to the nature of the discharge and, in the case of the permitted outfalls, that the discharge is regulated by the Tennessee Department of Environment and Conservation, Division of Water Pollution Control. The following is given as an example of the minimal amount of information that must be included on the sign:

TREATED INDUSTRIAL WASTEWATER
ARNOLD ENGINEERING DEVELOPMENT CENTER
(Permittee's Phone Number)
NPDES Permit NO. TN0003751
TENNESSEE DIVISION OF WATER POLLUTION CONTROL
1-888-891-8332 ENVIRONMENTAL ASSISTANCE CENTER - COLUMBIA

INDUSTRIAL STORM WATER RUNOFF
ARNOLD ENGINEERING DEVELOPMENT CENTER
(Permittee's Phone Number)
NPDES Permit NO. TN0003751
TENNESSEE DIVISION OF WATER POLLUTION CONTROL
1-888-891-8332 ENVIRONMENTAL ASSISTANCE CENTER - COLUMBIA

D. ANTIDEGRADATION

Pursuant to the Rules of the Tennessee Department of Environment and Conservation, Chapter 1200-4-3-.06, titled "Tennessee Antidegradation Statement," and in consideration of the Department's directive in attaining the greatest degree of effluent reduction achievable in municipal, industrial, and other wastes, the permittee shall further be required, pursuant to the terms and conditions of this permit, to comply with the effluent limitations and schedules of compliance required to implement applicable water quality standards, to comply with a State Water Quality Plan or other State or Federal laws or regulations, or where practicable, to comply with a standard permitting no discharge of pollutants.

E. BIOMONITORING REQUIREMENTS, CHRONIC

The permittee shall conduct a 3-Brood *Ceriodaphnia dubia* Survival and Reproduction Test and a 7-Day Fathead Minnow *(Pimephales promelas)* Larval Survival and Growth Test on the same samples of final effluent from Outfall 001.

The measured endpoint for toxicity will be the inhibition concentration causing 25% reduction (IC25) in survival, reproduction, or growth of the test organisms. The IC25 shall be determined based on a 25% reduction as compared to the controls. The average reproduction and growth responses will be determined based on the number of *Ceriodaphnia dubia* or *Pimephales promelas* larvae used to initiate the test.

Test shall be conducted and its results reported based on appropriate replicates of a total of five serial dilutions and a control, using the percent effluent dilutions as presented in the following table:

Serial Dilutions for Whole Effluent Toxicity (WET) Testing					
Permit Limit (PL)	**0.50 X PL**	**0.25 X PL**	**0.125 X PL**	**0.0625 X PL**	**Control**
% effluent					
100	**50**	**25**	**12.5**	**6.25**	**0**

The dilution/control water used will be a moderately hard water as described in Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms, EPA-821-R-02-013 (or the most current edition). Results from a chronic standard reference toxicant quality assurance test for each species tested shall be submitted with the discharge monitoring report. Reference toxicant tests shall be conducted as required in EPA-821-R-02-013 (or the most current edition). Additionally, the analysis of this multi-concentration test shall include review of the concentration-response relationship to ensure that calculated test results are interpreted appropriately.

Toxicity will be demonstrated if the IC25 is less than or equal to the permit limit indicated for each outfall in the above table(s). Toxicity demonstrated by the tests specified herein constitutes a violation of this permit.

When tests are conducted on-site, test solutions can be renewed daily with freshly collected samples. When tests are conducted off-site, a minimum of three 24-hour flow-proportionate composite samples of final effluent samples should be collected. If these samples are collected on Test Days 1, 3, and 5, the first sample would be used for test initiation, and for test solution renewal on Day 2. The second sample would be used for test solution renewal on Days 3 and 4. The third sample would be used for test solution renewal on Days 5, 6, and 7.If, in any control more than 20% of the test organisms die in 7 days, the test (control and effluent) is considered invalid and the test shall be repeated within 30 days of the date the initial test is invalidated. Furthermore, if the results do not meet the acceptability criteria of section 4.9.1, EPA-821-R-02-013 (or the most current edition), or if the required concentration-response review fails to yield a valid relationship per guidance contained in Method Guidance and Recommendations for Whole Effluent Toxicity (WET) Testing, EPA-821-B-00-004 (or the most current edition), that test shall be repeated. Any test initiated but terminated before completion must also be reported along with a complete explanation for the termination.

The toxicity tests specified herein shall be conducted semi-annually (2/Year) for Outfall 001 and begin no later than 90 days from the effective date of this permit.

In the event of a test failure, the permittee must start a follow-up test within 2 weeks and submit results from a follow-up test within 30 days from obtaining initial WET testing results. The follow-up test must be conducted using the same serial dilutions as presented in the corresponding table(s) above. **The follow-up test will not negate an initial failed test. In addition, the failure of a follow-up test will constitute a separate permit violation which must also be reported.**

In the event of 2 consecutive test failures or 3 test failures within a 12 month period for the same outfall, the permittee must initiate a Toxicity Identification Evaluation/Toxicity Reduction Evaluation (TIE/TRE) study within 30 days and so notify the Division by letter. This notification shall include a schedule of activities for the initial investigation of that outfall. **During the term of the TIE/TRE study, the frequency of biomonitoring shall be once every three months.** Additionally, the permittee shall submit progress reports once every three months throughout the term of the TIE/TRE study. The toxicity must be reduced to allowable limits for that outfall within 2 years of initiation of the TIE/TRE study. Subsequent to the results obtained from the TIE/TRE studies, the permittee may request an extension of the TIE/TRE study period if necessary to conduct further analyses. The final determination of any extension period will be made at the discretion of the Division.

The TIE/TRE study may be terminated at any time upon the completion and submission of 2 consecutive tests (for the same outfall) demonstrating compliance. Following the completion of TIE/TRE study, the frequency of monitoring will return to a regular schedule, as defined previously in this section as well in Part I of the permit. **During the course of the TIE/TRE study, the permittee will continue to conduct toxicity testing of the outfall being investigated at the frequency of once every three months but will not be required to perform follow-up tests for that outfall during the period of TIE/TRE study.**

Test procedures, quality assurance practices, determinations of effluent survival/reproduction and survival/growth values, and report formats will be made in accordance with Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms, EPA-821-R-02-013, or the most current edition, as well as applicable methods prescribed in Title 40, CFR, Part 136, as amended, promulgated pursuant to Section 304 (h) of the Act.

Results of all tests, reference toxicant information, copies of raw data sheets, statistical analysis and chemical analyses shall be compiled in a report. The report will be written in accordance with Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms, EPA-821-R-02-013, or the most current edition.

Two copies of biomonitoring reports (including follow-up reports) shall be submitted to the Division. One copy of the report shall be submitted along with the discharge monitoring report (DMR). The second copy shall be submitted to the local Division of Water Pollution Control office address:

Environmental Assistance Center- Columbia
Division of Water Pollution Control
2484 Park Plus Drive
Columbia, TN 38401-

F. FISH TISSUE SAMPLING

The permittee shall conduct fish tissue studies to determine the existence and extent of chemical contaminants in the form of polychlorinated biphenyls (PCBs) which may accumulate in fish and shellfish. These studies should be conducted pursuant to the EPA's Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 1, Fish Sampling and Analysis, EPA 823-R-93-002, August, 1993 (or the most current edition). Specifically, the guidance document addresses sample collection frequency, target species, target analytes, and sample make-up.

Sampling Location

The sampling locations illustrated in Figure 2 of "Woods Reservoir Fish Tissue PCB Environmental Monitoring Results for October 1996," AEDC submittal, January, 1997 will continue to be used for the follow-up sampling sites. Based on the update from the AEDC's permit application (page 2), Rowland Creek embayment PCB sampling will be expanded slightly to include the area of the lake north of the causeway, which was inadvertently left off the sampling area in the past.

Sampling Frequency

Biennial (every other year) screening of the waterbodies shall be required, with the next biennial study to be conducted during 2004.

Target Analytes

The target analytes of interest are PCBs and DDT.

Freshwater Target Species:

For each sample event one bottom feeding fish species, one catfish, and one predator fish species should be collected at each screening site.

Suggested target species for use in the fish contaminant monitoring programs for inland fresh waters are summarized below. The species are listed in the order of preference for sampling. The target size ranges are from the Mid-America Fish Contaminants Group's, Fish Sampling Guidelines, Proceedings of Fifth Meeting Dated August 3, 1989. The EPA Guidance Manual discusses evaluating species from target size ranges but does not specify any size ranges; therefore, the Division has included the Mid America Group's size ranges in the table summary (species listed in order of preference).

Predators	Size (in.)	Bottom Feeders	Size (in.)	Catfish	Size (in.)
Largemouth Bass	10-18	Common Carp	15-24	Channel Catfish	12-24
Smallmouth Bass	10-18	White Sucker	NA	Flathead Catfish	12-24
Black Crappie	8-12				
White Crappie	8-12				

Sampling Times

Sampling should take place in late summer to early fall (i.e., August to October). The lipid content of many species (which represents an important reservoir for organic pollutants) is generally highest at this time. Also, water levels are typically lower during this time, thus simplifying collections procedures.

Sample Type:

Composite samples of fish fillets are recommended for analysis of target analytes in the screening studies. For health risk assessments, a composite sample should consist of that portion of the individual organism that is commonly consumed by the population at risk. Skin-on fillets (with belly flap included) are recommended for most scaled finfish. Other sample types (e.g., skinless fillets) may be more appropriate for some target species (e.g., catfish and other scaleless finfish species).

In screening studies , EPA recommends that an analysis be made on one composite sample for each of three target species at each screening site. Organisms used in a composite sample should conform to the following guidelines.

1. Must all be of the same species.

2. Should be in the target size range listed herein.

3. Should be of similar size so that the smallest individual in a composite is no less than 75% of the total length (size) of the largest individual.

4. Should be collected at the same time i.e., collected as close to the same time as possible but no more than 1 week apart. NOTE: This assumes that a sampling crew was unable to collect all fish needed to prepare the composite sample on the same day. If organisms used in the same composite are collected on different days (no more than 1 week apart), they should be processed within 24 hours as described in Section 7.2 of the Guidance Manual, except that individual fish may have to be filleted and frozen until all the fish to be included in the composite

are delivered to the laboratory. At that time, the composite homogenate sample may be prepared.

5. Should be collected in sufficient numbers (3-10 fish) to provide a 200-g composite homogenate sample of edible tissue for analysis of recommended target analytes.

G. GROUNDWATER REMEDIATION TREATMENT SYSTEMS

In addition to the monitoring requirements specified for Outfall 006 and Internal Monitoring Points (IMPs) 01A, 01B, 01C, 01D, 01E & 02A, the permittee shall document the operational and maintenance history of each remediation site treatment system. This shall include, but not be limited to:

1. Influent intermediate, (between major treatment system components), and effluent concentration of appropriate effluent characteristics.
2. Records of maintenance activities and inspections.
3. Equipment failures and corrective action taken.
4. Other information pertinent to treatment system operation or performance.

Documentation shall be retained at the facility in accordance with the record retention requirements for monitoring data specified in Part I, B., 5 of this permit. Documentation and records shall be made available to Division of Water Pollution Control personnel on request.

PART IV

STORM WATER POLLUTION PREVENTION PLAN

The discharger will develop, document and maintain a storm water pollution prevention plan (SWPPP) pursuant to the requirements set forth in EPA guidance manuals titled "Storm Water Management for Industrial Activities, Developing Pollution Prevention Plans and Best Management Practices", (EPA 832-R-92-006), September, 1992, and the "Summary Guidance", (EPA 833-R-92-002), October, 1992. The plan shall be signed by either a principal executive officer of a corporation, the owner or proprietor of a sole proprietorship, or a partner or general partner of a partnership. The SWPPP developed and implemented shall be site specific to the permitted facility with regard to the general terms and conditions outlined in the guidance manuals cited herein, and, at a minimum, shall contain the following items:

A. POLLUTANT SOURCES AND PATHWAYS

1. A site map outlining the individual storm water drainage areas, existing structural control measures, surface water bodies, and sinkholes

2. A narrative description of significant materials (40 CFR 122.26) that are currently or in the past have been treated, stored, or disposed outside; materials management practices; existing structural and non-structural control measures to reduce pollutants; and a description of any storm water treatment

3. A list of significant spills and leaks of toxic or hazardous pollutants at the facility that have taken place after the effective date of the permit

4. A prediction of direction of flow and the possible pollutants associated with each area of the plant that generates storm water

5. A record of available sampling data describing pollutants in storm water discharges

B. STORM WATER MANAGEMENT CONTROLS

1. Formulate a pollution prevention team with named individuals who will develop the storm water prevention plan and assist plant manager in its implementation.

2. Inventory types of materials handled and associated potential of release to storm water. Evaluate the following for potential pollutant contribution: loading and unloading operations, outdoor storage and manufacturing activities, dust or particulate generating processes, and on-site waste disposal practices. Consider toxicity of chemicals, quantity of chemicals, and history of leaks or spills of toxic or hazardous pollutants.

3. Design a preventive maintenance program including inspection and maintenance of storm water management devices and testing plant equipment and systems to uncover conditions which could cause failures.

4. Maintain a clean, orderly facility.

5. Establish prevention and response procedures. Identify potential spill areas and drainage points. Specify material handling procedures and storage requirements. Identify spill cleanup procedures and provide to responsible personnel. Make available to responsible personnel the necessary equipment to implement cleanup at all times when the facility is in operation.

6. Include in the plan a narrative of traditional storm water management practices, i.e., other than those which control the source of pollutants.

7. Identify areas of potentially high soil erosion and measures to limit erosion.

8. Train employees at all levels of responsibility in the components of the storm water prevention plan.

9. Identify qualified personnel to inspect equipment, plant areas, and material handling areas. Develop a tracking system to ensure corrective action and maintain records of inspections.

10. Designate a person in the plan who will keep records of spills or other discharges, inspections and maintenance activities, and information describing the quality and quantity of storm water discharges.

11. Identify any non-storm water discharges, and their source(s), associated with the storm water outfalls. In the event non-storm water discharges are discovered in combination with the storm water discharges, the permittee must submit the appropriate EPA form(s) for the characterization of these non-storm water discharges as warranted.

C. FACILITY INSPECTION

Responsible person(s) named in the plan will inspect the facility at least annually for the accuracy of the plan and maps, adequate measures to reduce pollutants in storm water runoff, and the need for additional controls. Records of these inspections will be maintained for a period of three years.

D. SPILL PREVENTION CONTROL AND COUNTERMEASURES

Storm water management programs may reflect requirements for spill prevention control and countermeasures (SPCC) plans under section 311 of the CWA.

E. PLAN REVIEW AND UPDATE

The plan will be reviewed and updated, if necessary, by the facility at least annually. The plan and all records will be retained for at least three years after expiration of this permit.

F. PLAN IMPLEMENTATION

The plan should be developed and available for review within 180 days after permit coverage. Facilities should implement the management practices as soon as possible, but not later than one year after permit coverage. Where new construction is necessary to implement the management plan, a construction schedule should be included. Construction should be completed as soon as possible.

G. PLAN AVAILABILITY

The plan will be maintained by the discharger on the site or at a nearby office. Copies of the plan will be submitted to the Division of Water Pollution Control within ten working days of any request.

H. PLAN MODIFICATION

The plan will be modified as required by the Director of the Division of Water Pollution Control.

I. MONITORING PLAN

The storm water discharges will be monitored as required in Part I. Section A., Effluent Limits and Monitoring Requirements, applicable to storm water outfalls. For each outfall monitored, the surface area and type of cover, for example, roof, pavement, grassy areas, gravel, will be identified.

J. SARA TITLE III, SECTION 313 PRIORITY CHEMICALS

The SWPPP shall include the following for those facilities subject to reporting requirements under SARA Title III, Section 313 for chemicals which are classified as Section 313 water priority chemicals:

1. In areas where Section 313 priority chemicals are stored, processed or otherwise handled, appropriate containment, drainage control and/or diversionary structures will be provided. At a minimum, one of the following preventive systems or its equivalent will be used:

a. Curbing, culverting, gutters, sewers or other forms of drainage control

b. Roofs, covers or other forms or protection to prevent storage piles from exposure to storm water and wind

2. The plan will include a discussion of measures taken to conform with the following applicable guidelines:

a. In liquid storage areas where storm water comes into contact with any equipment, tank container, or other vessel used for Section 313 water priority chemicals,

i. the tank or container must be compatible with Section 313 water priority chemical which it stores and

ii. the liquid storage areas shall be operated to minimize discharge of Section 313 chemicals.

b. Material storage areas for Section 313 water priority chemicals, other than liquids, will incorporate features which will minimize the discharge of Section 313 chemicals by reducing storm water contact.

c. Truck and rail car loading and unloading areas for Section 313 liquid chemicals will be operated to minimize discharges of chemicals. Appropriate measures may include placement and maintenance of drip pans for use when making and breaking hose connections; a spill contingency plan; and/or other equivalent measures.

d. In plant areas where Section 313 chemicals are transferred, processed or handled, piping, processing equipment, and materials handling equipment will be operated so as to minimize discharges of chemicals. Piping and equipment must be compatible with chemicals handled. Additional protection, including covers and guards to prevent exposure to wind, pressure relief vents, and overhangs or door skirts to enclose trailer ends at truck loading docks, will be implemented. Visual inspections or leak tests will be conducted on overhead piping that conveys Section 313 chemicals.

e. For discharges from areas covered by parts 2a, 2b, 2c, or 2d,

> **i.** the drainage should be restrained by manually-operated valves or other positive means to prevent the discharge of a spill or excessive leakage,
>
> **ii.** a flapper-type drain valves can not be used for drainage of containment units,
>
> **iii.** the final discharge of in-facility storm sewers should be equipped with a diversion system that could, in the event of an uncontrolled spill of a Section 313 chemical, return the spilled material to the facility, and
>
> **iv.** the records of the frequency and estimated volume (in gallons) of discharges from containment areas will be maintained.

f. Facility site runoff other than from areas covered by parts 2a, 2b, 2c, and 2d from which runoff could contain Section 313 chemicals will incorporate the necessary drainage or other control features to prevent discharge of spilled or improperly disposed material and to ensure the reduction of pollutants in runoff or leachate.

g. All areas of the facility will be inspected at specific intervals for leaks or conditions that could lead to discharges of Section 313 water priority chemicals or direct contact of storm water with raw materials, intermediate materials, waste materials or products. Inspection intervals shall be specified in the plan and shall be based on design and operations experience. Corrective action will be taken promptly when a leak or condition, which could cause significant releases of a chemical is discovered. If corrective action can't be taken immediately, the unit or process will be shut down until the situation is corrected. When a leak or spill has occurred, the contaminated material(s) must be promptly removed and disposed in accordance with Federal, State, and local requirements and as described in the plan.

h. Facilities will have the necessary security systems to prevent accidental or intentionally entry, which could cause a discharge.

i. Facility employees and contract personnel that work in areas where SARA title III, Section 313 water priority chemicals are used or stored will be trained in and informed of preventive measures at the facility. Employee training shall be conducted at least once per year in the pollution control laws and regulations and in the storm water prevention plan. The plan shall designate a person who is accountable for spill prevention at the facility and who will set up the necessary spill emergency procedures and reporting requirements.

j. The SWPPP for a facility subject to SARA Title III, Section 313 requirements will be reviewed and certified by a responsible corporate officer in accordance to Part I.D.1 (Monitoring Results) of this permit. The corporate officer will certify the plan every three years thereafter, or as soon as practical, after significant modifications are made to the facility. Certification will in no way relieve the owner or operator of a facility covered by the plan of their duty to prepare and fully implement such plan.

3. "Section 313 water priority chemicals" means the following chemicals or chemical categories:

a. listed at 40 CFR 372.65 pursuant to Section 313 of Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986, also titled the Emergency Planning and Community Right-to-Know Act of 1986;

b. present at or above threshold levels at a facility subject to SARA Title III, Section 313 reporting requirements; and

c. meeting at least one of the following criteria:

i. listed in Appendix D of 40 CFR 122 on either Table II (organic priority pollutants), Table III (certain metals, cyanides, and phenols) or Table V (certain toxic pollutants and hazardous substances);

ii. listed as a hazardous substance pursuant to section 311(b)(2)(A) of the CWA at 40 CFR 116.4; or

iii. designated as pollutants for which EPA has published acute or chronic toxicity criteria.

SECOND ADDENDUM TO RATIONALE
Arnold Engineering Development Center
PERMIT NO. TN0003751

October 11, 2004
Addendum prepared by: Mr. Vojin Janjic

In a letter prepared by Mr. Charles H. King, Chief, Environmental Management Division dated May 13, 2004, Arnold Engineering Development Center submitted a request for a modification of the NPDES Permit No. TN0003751. The modification to the existing permit was requested to allow for the occasional discharge of cooling water, process and non-process wastewater from presently permitted Outfalls SW2 and SW3. The current permit recognizes that these outfalls discharge, but only in response to large storm events (during periods of heavy rainfall that exceeds the pumping station capacity). In addition, the modified permit will recognize and limit discharges during scheduled maintenance activities that require shutdown of the pumping station and system malfunctions. The nature of wastewater or its characteristics will not be altered as a result of the proposed modification. Based on the current parameters monitored at Outfalls SW2 and SW3, information in application forms 2C and provisions in other individual NPDES permits recently issued by the division, the division proposes following effluent limitations and monitoring requirements at Outfalls 002 and 003:

PERMIT LIMITS

Dry Weather Discharges - Outfalls 002 and 003
Discharge during scheduled maintenance activities that require shutdown of the pumping station and system malfunctions.

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE *
FLOW	--	--	Report (MGD) *		1/Discharge	Instantaneous
pH ***	Range 6.5 to 9.0				1/Discharge	Grab
TEMPERATURE, Effluent	Report effluent temperature (°C)				1/Discharge	Grab
COD	--	--	Report	--	1/Discharge	Grab
TOTAL SUSPENDED SOLIDS (TSS)	--	--	40	--	1/Discharge	Grab
OIL & GREASE	--	--	15	--	1/Discharge	Grab

* Flow shall be reported in Million Gallons per Day (MGD)
** pH analyses shall be performed within 15 minutes following sample collection.
*** Once per discharge, or once per week, whichever is less frequent.

The State of Tennessee Water Quality Standards [Chapter 1200-4-3] (WQS) became effective January 7, 2004. The criteria used for protection of designated uses in receiving streams for coliform bacteria was changed in the new WQS from "fecal coliform" to "E. Coli." As a result, all monitoring requirements for fecal coliform in this proposed modified permit will be removed. Furthermore, the effluent limitations for E. Coli will be updated to reflect the new WQS. The concentration of the E. coli group shall not exceed 126 colony forming units per 100 ml, as a geometric mean based on a minimum of 5 samples collected from a given sampling site over a period of not more than 30 consecutive days with individual samples being collected at intervals of not less than 12 hours. For the purposes of determining the geometric mean, individual samples having an E. coli concentration of less than 1 per 100 ml shall be considered as having a concentration of 1 per 100 ml.

Additionally, the concentration of the E. coli group in any individual sample taken from a lake, reservoir, State Scenic River, or Tier II or III stream (1200-4-3-.06) shall not exceed 487 colony forming units per 100 ml. The concentration of the E. coli group in any individual sample taken from any other waterbody shall not exceed 941 colony forming units per 100 ml.

The effluent limitations, monitoring requirements and other conditions for dry and wet weather discharges from all other outfalls at a facility, as described in the NPDES Permit TN0003751, remain unchanged.

VMJ

Second Addendum to Rationale TN0003751.DOC

ADDENDUM TO RATIONALE
Arnold Engineering Development Center
PERMIT NO. TN0003751

April 16, 2003
Addendum prepared by: Mr. Vojin Janjic

In a letter prepared by Mr. Frank A. Duncan, Deputy Chief, Environmental Mgmt Division dated February 24, 2003, Arnold Engineering Development Center (AEDC) submitted comments regarding proposed NPDES Permit No. TN0003751. In addition, comments regarding this draft NPDES permit were also submitted by Ms. Connie Kagey, U.S. EPA, Region IV.

This addendum to rationale describes changes, corrections and modifications, or further clarifies any issues regarding effluent limitations, monitoring and other requirements associated with the above referenced individual NPDES permit proposed to be issued by the Division of Water Pollution Control (the division).

Proposed Outfalls 009 and 010

These two point source discharges were identified in the permit application as "proposed Outfalls 009 and 010." Proposed Outfall 009 contains subsurface seeps from an earthen dam below the flow-through retention pond, discharge from which is permitted as Outfall 001. These seeps become contaminated with trichloroethylene (TCE) during subsurface contact with an adjacent site designated as Solid Waste Management Unit 16 (SWMU 16). Proposed Outfall 010 contains leachate seeps not collected in the leachate collection system from an inactive landfill, identified as Solid Waste Management Unit 16 (SWMU 5). Except during excessive rainfall events, leachate from the leachate collection system is discharged into the City of Manchester's wastewater treatment plant. Both discharges are being evaluated and managed as a part of facility's corrective action program, coordinated with the TDEC's RCRA office. Consequently, AEDC requested to maintain status of discharges as a part of facility's corrective action program regulated by TDEC's Division of Solid Waste Management, without identification as formal outfalls in the reissued NPDES permit. Upon review of analytical data contained in the permit application, the division agrees with AEDC's proposal to maintain status of discharges identified as 009 and 010 as a part of facility's corrective action program regulated by TDEC's Division of Solid Waste Management. The division maintains the authority to regulate these discharges as NPDES permitted outfalls and/or institute specific numeric limitations, if warranted, in the future.

Selenium Sampling at Outfall 001

The proposed permit contained effluent limitations and monitoring requirements for total selenium at Outfall 001. Addition of selenium was based on the effluent concentration present in facility's effluent, as presented in the permit application. AECD objected to selenium sampling requirement and presented the division with additional data. Two sets of samples were collected one week apart at Outfall 001 and a raw water intake. Background samples were collected at the same time at Elk River, Bean's Creek and Bradley Creek. Selenium was detected at all locations except at the facility's Outfall 001. The exact sampling locations, dates and concentrations provided in Mr. Duncan's letter will be placed in the facility's file and are available for review. Based on the additional information, the division agrees with AEDC's proposal to remove selenium monitoring from the proposed permit.

Silver Sampling at Outfall 001

The proposed permit contains effluent limitations and monitoring requirements for total silver. Water quality calculations (see Rationale, R-24) showed that the concentration protective of Criterion Maximum Concentration (CMC) for a designated use of "Fish and Aquatic Life" is 0.0029 mg/L. The permit application contained only one data point, stating that total silver concentration at Outfall 001 was measured as <0.003 mg/L. Based on this information, a reasonable potential exists for the facility's effluent to cause an exceedance of the CMC value in the receiving stream under critical low flow conditions; consequently, the effluent limitation for total silver was added. Please note that the information submitted in the permit application (<0.003 mg/L) does not comply with the Required Detection Level (RDL) per State of Tennessee Rule 1200-4-3-.05(8), which is 0.001 mg/L (see Rationale, page R-25). We recognize that silver was traditionally not considered as a pollutant of concern at Outfall 001, neither by the type of wastewater generated at the site, or from previous permit applications. As a result, effluent limitations and monitoring requirements table at Outfall 001 will incorporate a statement that sampling for total silver will be removed if, after the first year of sampling, the concentrations are always below the RDL (0.001 mg/L). If total silver is detected in any of the Outfall 001 samples, monitoring will be continued for the term of the permit on a monthly basis.

Detection Level for Total Residual Chlorine (TRC)

The acceptable methods for detection of TRC are any methods specified in 40 CFR Part 136 that reach a detection level allowing accurate evaluation of compliance with the permit limits. The required analytical quantitation level for TRC is the permit limit or 0.05 mg/L, whichever is lower. In cases where there appears to be matrix interferences, and the permit limit is less than 0.05, the permittee may use 0.05 mg/L as the analytical quantitation level that shall be used for compliance evaluations. A quantitation level other than 0.05 mg/L may be appropriate, but the permittee will not be approved to use it without supporting data for the wastewater in question. During the previous permit term, AEDC demonstrated that reporting of TRC concentrations less than 0.1 mg/L were unreliable. AEDC initially requested to extend the use of corrected detection level in the reissued permit. However, upon further investigation by AEDC personnel and consultation with US-EPA Region 4 Laboratory (Science and Ecosystem Support Division-SESD) in Athens, Georgia, it was concluded that a detection level of 0.05 mg/L can be achieved at the facility, and will be required in the reissued NPDES permit.

VMJ

Permit Addendum TN0003751.DOC

RATIONALE

Arnold Engineering Development Center
NPDES PERMIT NO. TN0003751
Tullahoma, Franklin County, Tennessee

Permit Writer: Mr. Vojin Janjic

I. DISCHARGER

Arnold Engineering Development Center
Tullahoma, Franklin County, Tennessee

Official Contact Person:
Mr. Charles H. King
Chief, Environmental Mgmt Division
931 454-7115

Nature of Business:
Testing of aerospace systems and components in aerodynamic, propulsion, and space environmental ground test facilities that simulate flight conditions. The facility also develops advanced test techniques, instrumentation, and facilities through research and new technology application

SIC Code(s): 9711 (National Security)
Industrial Classification: Secondary w/o ELG
Discharger Rating: Major

II. PERMIT STATUS

Issued February 27, 1998
Expired February 28, 2002
Application for renewal received August 27, 2001

Watershed Scheduling

Environmental Assistance Center: Columbia
Primary Longitude: -86.058333 Primary Latitude: 35.370833
Hydrocode: 6030003 Watershed Group: 2
Watershed Identification: Elk-Upper
Target Reissuance Year: 2007

III. FACILITY DISCHARGES AND RECEIVING WATERS

Arnold Engineering Development Center (AEDC) is a large complex of flight simulation test facilities and includes 53 aerodynamic and propulsion wind tunnels, rocket and turbine engine test cells, space environmental chambers, arc heaters, ballistic ranges, and other specialized units. Arnold Engineering Development Center discharges treated process wastewater, non-process wastewater, sanitary wastewater, remediated groundwater and storm water runoff from Outfall 001; process wastewater, non-process wastewater, remediated groundwater, and storm water runoff from Outfall SW2; process wastewater, non-process wastewater and storm water runoff from Outfall SW3 (including Outfall 005); treated sanitary wastewater from Outfall 004; steam plant condensate and steam plant reverse osmosis wastewater, process wastewater, noncontact cooling water and storm water runoff from Outfall 005; treated groundwater from Outfall 006; nonprocess wastewater, building groundwater drainage, and non-industrial storm water from Outfall 007; and noncontact cooling water and non-industrial storm water from Outfall 008 to unnamed tributary to Rowland Creek (001); unnamed tributary to Bradley Creek (SW2 & 007); unnamed tributary to Brumalow Creek (SW3 & 005); unnamed tributary to Spring Creek (006); and Woods Reservoir (004 & 008). Appendix 1 summarizes facility discharges and the receiving stream information for all outfalls.

It should be noted that the wastestream flows listed for Outfall 001 represent long term average flows. Due to the nature of test operations at the facility, the peak flows of several of the individual wastestreams routed into the retention pond may be many times higher than the long term average flows, but only for short periods of time. Furthermore, the storm water outfall designated as SW1 in the permit application represents the same physical location as Outfall 001. Considering long residence time in the retention pond (>24 hours), storm water sampling during wet weather conditions would not provide any additional effluent information, nor would be specific for or representative of wet weather conditions. Therefore, as in the previous permit, storm water runoff for the corresponding drainage area will be monitored through effluent limitations and requirements already established for Outfall 001.

In the past, process wastewater, nonprocess wastewater, and storm water runoff were discharged from Outfall SW2 to Bradley Creek and from Outfall SW3 to Brumalow Creek. Pumping stations were installed downstream of process and nonprocess wastestreams and upstream of the Outfalls SW2 & SW3 compliance points to provide recirculation of water for cooling. The pump capacity at each station is 2-3 times the average non-storm water flow rate and flow in excess of pumping capacity occurs only during large storm events. For the purposes of this permit, the compliance points for the effluent discharged during "wet weather" conditions directly to unnamed tributaries to Bradley Creek and Brumalow Creek are designated Outfalls SW2 & SW3, respectively.

The facility discharges in the reissued permit have been grouped into eight outfalls (see above text and Appendix 1). Internal monitoring points have been specified for several Outfall 001 & 006 wastestreams to verify proper operation of treatment systems specific to those wastestreams. The internal monitoring points in the new permit do not necessarily correspond to the internal monitoring points in the previous permit:

Outfall	IMP	Wastestream
001	01A	AEDC Main STP
001	01B	ASTF Groundwater Treatment Unit
001	01C	Site 1 Groundwater Treatment Unit
001	01D	Site 22 Groundwater Treatment Unit
001	01E	AC&T air stripper
001	02A	Site 8 Groundwater Treatment Unit

IV. APPLICABLE EFFLUENT LIMITATIONS GUIDELINES

There are no EPA effluent guidelines for the discharges from this facility. Standards of performance are therefore established in accordance with existing state regulations using available treatability information.

This facility is one which has "storm water associated with industrial activity" under the storm water regulations in 40 CFR Part 122.26(b)(14).

V. PREVIOUS PERMIT LIMITS AND MONITORING REQUIREMENTS

Appendix 2 lists the permit limitations and monitoring requirements as defined in the previous permit.

VI. HISTORICAL MONITORING AND INSPECTION

During the previous permit term, Arnold Engineering Development Center did have some difficulty in meeting effluent limitations as outlined in the previous permit. A summary of the effluent limitations exceedances reported on Discharge Monitoring Report forms during the previous permit term is summarized in Appendix 3.

VII. NEW PERMIT LIMITS AND MONITORING REQUIREMENTS

The proposed new permit limits have been selected by determining a technology-based limit and evaluating if that limit protects the water quality of the receiving stream. If the technology-based limit would cause violations of water quality, the water quality-based limit is chosen. The technology-based limit is determined from EPA effluent limitations guidelines if applicable (see Part IV); or from State of Tennessee maximum effluent limits for effluent limited segments per Rule 1200-4-5-.03(2); or by way of operational and/or treatability data. Furthermore, effluent limitations in this permit must comply with any approved Total Maximum Daily Load (TMDL) studies. Appendix 4 lists all proposed effluent limitations and monitoring requirements to be included in the new permit.

The following procedure is used to calculate the allowable instream concentrations for permit limitations. If monitoring for a particular pollutant indicates that the pollutant is not present (i.e., consistently below detection level), then the Division may drop the monitoring requirements in the reissued permit.

1. The most recent background conditions of the receiving stream segment are compiled. This information includes:

   * 7Q10 of receiving stream
   * Calcium hardness
   * Total suspended solids
   * Background metals concentrations (or ½ water quality criteria)
   * Other dischargers impacting this segment (none)
   * Downstream water supplies, if applicable

2. The chronic water quality criteria is converted from total recoverable metal at lab conditions to dissolved lab conditions for the following metals: cadmium, copper, lead, nickel and zinc. Then translators are used to convert the dissolved lab conditions to total recoverable metal at ambient conditions.

3. The acute water quality criteria is converted from total recoverable metal at lab conditions to dissolved lab conditions for the following metals: cadmium, copper, lead, nickel, zinc, silver and mercury. Then translators are used to convert the dissolved lab conditions to total recoverable metal at ambient conditions for the following metals: cadmium, copper, lead, nickel, silver and mercury.

4. The chronic criteria for Chromium (T) is given in the total recoverable form and is not converted to a dissolved lab condition or to the total recoverable ambient condition.

5. A standard mass balance equation determines the total allowable concentration (permit limit) for each pollutant. This equation also includes a percent stream allocation of 100%.

The following formulas are used to evaluate water quality protection:

$$Cm = \frac{QsCs + QwCw}{Qs + Qw}$$

where:

Cm = resulting in-stream concentration after mixing
Cw = concentration of pollutant in wastewater
Cs = stream background concentration
Qw = wastewater flow
Qs = stream low flow

to protect water quality:

$$Cw \leq \frac{(S_A)\,[Cm\,(Qs + Qw) - QsCs]}{Qw}$$

where (S_A) is the percent “Stream Allocation”.

Calculations for this permit have been done using a standardized worksheet, titled "Water Quality Based Effluent Calculations." Division policy dictates the following procedures in establishing these permit limits:

1. The critical low flow values are determined using USGS data:

   Fish and Aquatic Life Protection
   7Q10 - Low flow under natural conditions
   1Q10 - Regulated low flow conditions

   Other than Fish and Aquatic Life Protection
   30Q2 - Low flow under natural conditions

2. Fish & Aquatic Life water quality criteria for certain Metals are developed through application of hardness dependent equations. These criteria are combined with dissolved fraction methodologies in order to formulate the final effluent concentrations.

3. For criteria that are hardness dependent, chronic and acute concentrations are based on a Hardness of 25 mg/l and Total Suspended Solids (TSS) of 10 mg/l unless STORET or Water Supply intake data substantiate a different value. Minimum and maximum limits on the hardness value used for water quality calculations are 25 mg/l and 400 mg/l respectively. The minimum limit on the TSS value used for water quality calculations is 10 mg/l.

4. Background concentrations are determined from the Division database, results of sampling obtained from the permittee, and/or obtained from nearby stream sampling data. If this background data is not sufficient, one-half of the chronic "In-stream Allowable" water quality criteria for fish and aquatic life is used. If the measured background concentration is greater than the chronic "In-stream Allowable" water quality criteria, then the measured background concentration is used in lieu of the chronic "In-stream Allowable" water quality criteria for the purpose of calculating the appropriate effluent limitation (Cw). Under these circumstances, and in the event the "stream allocation" is less than 100%, the calculated chronic effluent limitation for fish and aquatic life should be equal to the chronic "In-stream Allowable" water quality criteria. These guidelines should be strictly followed where the industrial source water is not the receiving stream. Where the industrial source water is the receiving stream, and the measured background concentration is greater than the chronic "In-stream Allowable" water quality criteria, consideration may be given as to the degree to which the permittee should be required to meet the requirements of the water quality criteria in view of the nature and characteristics of the receiving stream.

The spreadsheet has fourteen (14) data columns, all of which may not be applicable to any particular characteristic constituent of the discharge. A description of each column is as follows:

Column 1: The "Stream Background" concentrations of the effluent characteristics.

Column 2: The "Chronic" Fish and Aquatic Life Water Quality criteria. For Cadmium, Copper, Lead, Nickel, and Zinc, this value represents the criteria for the dissolved form at laboratory conditions. The Criteria Continuous Concentration (CCC) is calculated using the equation:

$$CCC = (\exp\{ m_C [\ln (\text{stream hardness})] + b_C \}) (CCF)$$

CCF = Chronic Conversion Factor

This equation and the appropriate coefficients for each metal are from Tennessee Rule 1200-4-3-.03 and the EPA guidance contained *in The Metals Translator: Guidance For Calculating A Total Recoverable Permit Limit From a Dissolved Criterion* (EPA 823-B-96-007, June 1996). Values for other metals are in the total form and are not hardness dependent; no chronic criteria exists for silver. Published criteria are used for non-metal parameters.

Column 3: The "Acute" Fish and Aquatic Life Water Quality criteria. For Cadmium, Copper, Lead, Nickel, Silver, and Zinc, this value represents the criteria for the dissolved form at laboratory conditions. The Criteria Maximum Concentration (CMC) is calculated using the equation:

$$CMC = (\exp\{ m_A [\ln (\text{stream hardness})] + b_A \}) (ACF)$$

ACF = Acute Conversion Factor

This equation and the appropriate coefficients for each metal are from Tennessee Rule 1200-4-3-.03 and the EPA guidance contained in *The Metals Translator: Guidance For Calculating A Total Recoverable Permit Limit From a Dissolved Criterion* (EPA 823-B-96-007, June 1996). Values for other metals are in the total form and are not hardness dependent; no acute criteria exists for Total Chromium. Published criteria are used for non-metal parameters.

Column 4: The "Fraction Dissolved" converts the value for dissolved metal at laboratory conditions (columns 2 & 3) to total recoverable metal at in-stream ambient conditions (columns 5 & 6). This factor is calculated using the linear partition coefficients found in *The Metals Translator: Guidance For Calculating A Total Recoverable Permit Limit From a Dissolved Criterion* (EPA 823-B-96-007, June 1996) and the equation:

$$\frac{C_{diss}}{C_{total}} = \frac{1}{1 + \{ [K_{po}] [ss^{(1+a)}] [10^{-6}] \}}$$

ss = in-stream suspended solids concentration [mg/l]

Linear partition coefficients for streams are used for unregulated (7Q10) receiving waters, and linear partition coefficients for lakes are used for regulated (1Q10) receiving waters. For those parameters not in the dissolved form in columns 2 & 3 (and all non-metal parameters), a Translator of 1 is used.

Column 5: The "Chronic" Fish and Aquatic Life Water Quality criteria at in-stream ambient conditions. This criteria is calculated by dividing the value in column 2 by the value in column 4.

Column 6: The "Acute" Fish and Aquatic Life Water Quality criteria at in-stream ambient conditions. This criteria is calculated by dividing the value in column 3 by the value in column 4.

Column 7: The "Chronic" Calculated Effluent Concentration for the protection of fish and aquatic life. This is the chronic limit.

Column 8: The "Acute" Calculated Effluent Concentration for the protection of fish and aquatic life. This is the acute limit.

Column 9: The In-Stream Water Quality criteria for the protection of Human Health associated with the stream use classification of Organism Consumption (Recreation).

Column 10: The In-Stream Water Quality criteria for the protection of Human Health associated with the stream use classification of Water and Organism Consumption. These criteria are only to be applied when the stream use classification for the receiving stream includes both "Recreation" and "Domestic Water Supply."

Column 11: The In-Stream Water Quality criteria for the protection of Human Health associated with the stream use classification of Domestic Water Supply.

Column 12: The Calculated Effluent Concentration associated with Organism Consumption.

Column 13: The Calculated Effluent Concentration associated with Water and Organism Consumption.

Column 14: The Calculated Effluent Concentration associated with Domestic Water Supply.

The most stringent water quality effluent concentration from Columns 7, 8, 12, 13, and 14 is applied if the receiving stream is designated for domestic water supply. Otherwise, the most stringent effluent concentration is chosen from columns 7, 8, and 12 only. See attached calculations spreadsheet.

<u>Outfall 001</u>

Water quality limits for metals for which the Fish & Aquatic Life criteria are a function of stream hardness were calculated using the lowest recorded hardness value from data submitted by the permittee (71mg/l minimum; 87 mg/l average). Calculations for the new permit were made using hardness and TSS data collected in 1996. For both parameters, the median value (hardness: 90 mg/l; TSS: 16.75 mg/l) was more conservative than the average value and considered to be more representative of the complete data set. Water quality calculations for Outfall 001 are shown in Appendix 4a. New permit limits and monitoring requirements for all outfalls and Internal Monitoring Points are summarized in Appendix 4c.

As was the case with iron during the previous permit cycle, the State of Tennessee has no promulgated water quality criteria for aluminum and the concentration of aluminum in the discharge is lower than that in the intake water. The historic data submitted by AEDC reports a concentration of 1.8 mg/l in the Woods Reservoir intake water and an effluent concentration at Outfall 001 of 0.749 mg/l. Additional sampling of streams that enter Woods Reservoir upstream of the intake showed relatively high background levels of aluminum:

Sampling Site	Total Aluminum [mg/l]
Elk River @ Dabbs Ford Bridge	1.42
Bean's Creek @ Betsy Willis Road	0.96
Bradley Creek @ Hwy 41 (Hillsboro)	1.42
(samples collected on October 28, 1997)	

The only notable potential source of aluminum in the Outfall 001 discharge is quench water from solid rocket tests at the J-6 facility. One of the by-products of combustion in these tests is aluminum oxide which apparently settles out as an insoluble solid in the dehumidification chamber. This material is handled as a solid waste and is not believed to increase the concentration of aluminum in the wastestream. AEDC has collected discrete samples of the J-6 test cell effluent on May 21, 1997 and September 11, 1997. The average concentration of aluminum in these samples was 0.316 mg/l and 0.372 mg/l respectively. Based on this data, monitoring requirements for aluminum were not included in the new permit.

The cyanide limits in the previous permit appear to be originally derived from the 1976 "Red Book" (Quality Criteria For Water) and are more stringent than current State of Tennessee criteria for the protection of Fish & Aquatic Life (Criterion Continuous Concentration: 0.0052 mg/l; Criterion Maximum Concentration: 0.022 mg/l). In DMRs submitted during the term of the previous permit, AEDC reported cyanide concentration levels of less than 0.02 mg/l through September 1996 and less than 0.005 mg/l after that date. The State Required Detection Level (RDL) is 0.005 mg/l. The permit application states that AEDC has no processes that use cyanide and the only potential sources are byproducts of combustion from propulsion test cell fuels. The previous permit had the following provisional requirement for cyanide sampling: "If the concentration level reported on Discharge Monitoring Reports is below the Required Detection Level (RDL) specified in State of Tennessee Water Quality Standards, Rule 1200-4-3-.05(8) for the first 12 months after the effective date of this permit, sampling for cyanide will not be required for the remainder of the permit term. If the reported cyanide concentration is equal to, or exceeds, the RDL in any of the first 12 months after the effective date of this permit, sampling is required at the frequency indicated for the remainder of the permit term." The discharge concentration level was below the State RDL, as contemplated in the previous permit. In consideration of these circumstances, and based on the permittee's request, the division will remove the cyanide monitoring from the proposed permit.

Limits for $CBOD_5$, ammonia (as N), and dissolved oxygen have been retained from the previous permit and verified by a stream model of the receiving water (available in the division's facility file docket). The model was based on summer ambient conditions. Data submitted on DMRs indicate that the dual limits (summer and winter) for ammonia (as N) in previous permit are not necessary. The maximum reported ammonia (as N) concentration at Outfall 001 was 0.39 mg/L, which is less than one half of the permit limit. This retained Monthly Average limit is more stringent than the Criteria Continuous Concentrations (CCC, 4 day average) listed in EPA Memorandum dated December 1999 containing Update of Ambient Water Quality Criteria for Ammonia. The Daily Maximum limits for $CBOD_5$ and ammonia (as N) were based on the BPJ of the permit writer in consideration of current division practice.

Internal Monitoring Point 01A

The performance of the Main Sewage Treatment Plant will be verified by monitoring plant effluent at the Internal Monitoring Point (IMP) 01A. The limits and monitoring frequency for flow, pH, BOD_5, TSS, fecal coliform and settleable solids have been retained from the previous permit and are consistent with secondary treatment limits and the requirements imposed on municipal sewage treatment facilities of a similar capacity in the state. Sampling requirements for total residual chlorine have been deleted since AEDC switched to UV disinfection technology. Sampling and limitation for E. Coli was added to IMP 01A, based on the protection of recreation criteria and consistent with secondary treatment limits and the requirements imposed on municipal sewage treatment facilities of a similar capacity in the state.

Internal Monitoring Points 01B, 01C, 01D, 01E & 02A

The performance of groundwater treatment units will be verified by sampling of the treatment unit effluent at Internal Monitoring Points (IMPs) 01B, 01C, 01D, 01E and 02A. Parameters selected for monitoring at each IMP were based on information provided by the permittee and requirements contained in the previous permit. Monitoring will be required quarterly during the permit term. All sampling will be on a "Report" only basis. The permit also contains provisions for the documentation of the operational and maintenance history of each treatment unit.

Outfalls SW2 & SW3

Due to the recirculation of process wastewater, nonprocess wastewater, and storm water runoff (during small storm events), Outfalls SW 2 and SW3 discharge only in response to exceptionally large storm events that exceed the pumping station capacity. It is the opinion of the division that the best method for dealing with potential pollution associated with storm water discharges from the AEDC facility is through implementation of an aggressive Storm Water Pollution Prevention Plan (SWPPP) program (reference: Permit, Part IV) coupled with discharge monitoring to verify SWPPP effectiveness. Monitoring of storm water runoff from Outfalls SW2 & SW3 will be required for Flow, pH, BOD5, COD, TSS, and Oil & Grease on a semi-annual basis. In order to assist the permittee in the evaluation of the effectiveness of the SWPPP, benchmark values developed for the Tennessee Storm Water Multi-Sector General Permit for Industrial Activities are provided herein for comparison. These benchmark values are target concentrations and should not be construed to represent permit limits. The effectiveness of this SWPPP will be investigated after the results of the storm water runoff monitoring have been submitted. At that time, should the results so dictate, the Division maintains the authority to institute specific numeric limitations for the monitored parameters.

Parameters of Concern	Cut-Off Concentration [mg/L]
pH (range)	*5.0 - 9.0*
BOD (5-Day)	*30*
COD	*120*
Total Suspended Solids (TSS)	*200*
Oil & Grease	*15*

Note: Sample values are from the Tennessee Storm Water Multi-Sector General Permit for Industrial Activities, Rationale, Part III, Table III-A: *Parameter Benchmark Values.*

Outfall 004

Since there are no known adverse water quality impacts caused by this discharge, the technology based limits contained in the previous permit have been retained. Sampling and limitation for E. Coli was added to Outfall 004, based on the protection of recreation criteria and consistent with secondary treatment limits and the requirements imposed on municipal sewage treatment facilities of a similar capacity in the state.

Outfall 005

The steam plant condensate and steam plant reverse osmosis wastewater, noncontact cooling water and storm water runoff discharged at Outfall 005 will be monitored for flow, pH, oil & grease, and temperature. The limits specified for pH and temperature are derived from State of Tennessee Water Quality Standards, Chapter 1200-4-3.

Outfall 006

Technology based limits for the Outfall 006 discharge were calculated using influent concentrations provided by the permittee and a 99.9% removal percentage for the Site 6 groundwater remediation treatment system. The removal percentage was based on the BPJ of the permit writer in consideration of the performance characteristics of a well maintained treatment unit (air stripper + carbon adsorption).

Effluent Characteristic	Site 6 Average Influent Concentration [ug/l]	Removal Percentage [%]	Daily Maximum Technology Effluent Limit [ug/l]
1,1-Dichloroethene	5,000	99.9	5
Methylene Chloride	25,000	99.9	25

Technology based limits were compared to water quality criteria promulgated for the use classifications of the receiving stream. Since the receiving stream is considered to have zero flow for analysis purposes, water quality criteria are applicable at the point of discharge. For both 1,1-Dichlorethene and Methylene Chloride, the technology based limits were more stringent and are specified in the new permit.

Effluent Characteristic	Water Quality Chronic Criteria (Recreation) [ug/l]	Technology Based Limit [ug/l]	Daily Maximum Permit Limit [ug/l]
1,1-Dichloroethene	32	5	5
Methylene Chloride	16,000	25	25

<u>Outfall 007</u>

The nonprocess wastewater discharged at Outfall 007 will be monitored for flow and pH. The pH limits are derived from State of Tennessee Water Quality Standards, Chapter 1200-4-3-.03(3)(b) for the protection of Fish & Aquatic Life.

<u>Outfall 008</u>

The non-contact cooling water and non-industrial storm water runoff discharged from Outfall 008 will be monitored for flow, pH, and temperature. The limits specified for pH and temperature are derived from State of Tennessee Water Quality Standards, Chapter 1200-4-3. Due to the nature and quantity of the discharge and the size of the receiving waters, the monitoring frequency is specified as once per quarter.

<u>pH (applicable to all outfalls)</u>

According to the State of Tennessee Water Quality Standards [Chapter 1200-4-3-.03(3)(b)], the pH for the protection of Fish and Aquatic Life shall lie within the range of 6.5 to 9.0 and shall not fluctuate more than 1.0 unit in this range over a period of 24-hours. The Tennessee Rule 1200-4-5-.03(2), "Effluent Limitations for Effluent Limited Segments," establishes technology-based limits for pH within the range of 6.0 to 9.0. Considering that the receiving stream (Woods Reservoir) will provide some buffering capacity, effluent limitation for pH at Outfalls 004 and 008 will be limited in a range 6.0 to 9.0. Effluent limitation for pH for all other outfalls will be established in a range of 6.5 to 9.0. The sample type will be grab, except at Outfall 001, where it will be continuous.

According to 40 CFR §401.17(a), where a permittee continuously measures the pH of wastewater pursuant to a requirement or option in a NPDES permit (Outfall 001), the permittee shall maintain the pH of such wastewater within the range set forth in the applicable effluent limitations guidelines, except excursions from the range are permitted subject to the following limitations:

(1) The total time during which the pH values are outside the required range of pH values shall not exceed 7 hours and 26 minutes in any calendar month; and

(2) No individual excursion from the range of pH values shall exceed 60 minutes.

The above provision for pH exceedances was incorporated in the facility's previous permit and it will be retained in the new permit. It should be noted that the provision for pH exceedances as described in 40 CFR §401.17 is intended for discharges that are continuous in nature. According to 40 CFR 122.2 - *Definitions*, a continuous discharge means a discharge which occurs without interruption throughout the operating hours of the facility, except for infrequent shutdowns for maintenance, process changes, or other similar activities.

Effluent Temperature (applicable to all outfalls)

Temperature will be regulated according to the State of Tennessee Water Quality Standards for the protection of Fish & Aquatic Life [Chapter 1200-4-3-.03(3)(e)]. It is recognized that the temperature of various cooling water discharges will be greater than the temperature of the water prior to its use for cooling or other purposes. This discharge must not cause the temperature change in receiving stream to exceed 3°C relative to an upstream control point. Also, this discharge must not cause the temperature of receiving stream to exceed 30.5°C (except as a result of natural causes), and this discharge must not cause the maximum rate of temperature change in receiving stream to exceed 2°C per hour (except as a result of natural causes).

Considering that cooling water at all outfalls is mixed with other waste or storm water streams prior to discharge, the history of discharges from various outfalls reported on DMRs, a ratio of effluent flow and receiving stream critical low flow rates, in the permit writer's BPJ, there is no reasonable potential of exceeding any applicable temperature WQ criteria. Therefore, effluent temperature is monitored on "report only" basis on the Discharge Monitoring Reports (DMRs). Considering the reported temperature will be the one of the effluent, an exceedance of the above mentioned 30.5°C water quality criteria is not necessarily a permit violation. The 30.5°C value applies to the receiving stream, not the effluent. Therefore, if the effluent temperature exceeds 30.5°C, the permittee may perform a temperature check in the receiving stream below the discharge point in order to prove facility's compliance with the Tennessee Water Quality Standards. If such measurement is performed, it should be noted in the "comments" section of the DMR.

Fish Tissue Sampling

Woods Reservoir and its tributaries appear on the 303(d) list for partially or not supporting designated uses due to PCB contaminated sediments from past operations at the AEDC facility. AEDC has demonstrated to the division that PCBs are not present in current facility discharges. Due to historic contamination, however, the previous permit contained provisions for conducting environmental monitoring for polychlorinated biphenyls (PCBs) and DDT. The new permit retains this requirement and contains guidance addressing sample collection frequency, target species, target analytes, and sample make-up. This guidance is derived primarily from EPA's Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 1, Fish Sampling and Analysis, EPA 823-R-93-002, August, 1993. shall be conducted biennially (every other year).

VIII. BIOMONITORING REQUIREMENTS, CHRONIC

The discharge of industrial wastewater from Outfall 001 may contain several different pollutants, the combined effect of which has a reasonable potential to be detrimental to fish and aquatic life. The Tennessee Water Quality Standards criteria stipulates that "*The waters shall* *not contain toxic substances, whether alone or in combination with other substances, which will produce toxic conditions...".*

Since the permittee discharges to a stream with low critical flow conditions, there is a concern for toxicity effects of the discharge on the receiving stream which is relatively unknown. Biomonitoring will provide information relative to the toxicity of the discharge. Calculation of toxicity limits is as follows:

$$DF = \frac{Qs + Qw}{Qw} = \text{Dilution Factor}$$

where **Qw** is a wastewater flow (Qw = 45.11 MGD) and **Qs** is a receiving stream low flow (7Q10, 0.0 MGD). Please refer to Appendix 1 for details regarding facility discharge and receiving stream. Therefore,

$$DF = \frac{0 + 45.11}{45.11} = 1$$

Since the calculated dilution factor is less than 100:1, and assuming immediate and complete mixing, protection of the stream from chronic effects requires:

$$IWC \leq 1.0 \text{ X } IC25; \text{ or,}$$

$$\text{INHIBITION CONCENTRATION, } 25\% \geq IWC$$

Where IWC is Instream Waste Concentration and is calculated using the following formula:

$$IWC = \frac{Qw}{Qs + Qw} \text{ X } 100 = \text{Instream Waste Concentration}$$

$$IWC = \frac{45.11}{0 + 45.11} \text{ X } 100 = 100\%$$

Therefore, WET testing will be required on 100% effluent. If toxicity is demonstrated in any of the effluent samples specified above, this will constitute a violation of this permit.

The toxicity tests specified herein shall be conducted semi-annually (2/Year) for Outfall 001 and begin no later than 90 days from the effective date of this permit. The details regarding biomonitoring methodology can be found in Part III of the permit.

IX. ANTIDEGRADATION

Tennessee's Antidegradation Statement is found in the Rules of the Tennessee Department of Environment and Conservation, Chapter 1200-4-3-.06. This statement outlines the criteria for the two types of high quality waters. Outstanding National Resource Waters

(ONRWs), as designated by the Water Quality Control Board, are commonly referred to as Tier 3 waters. Other high quality waters, as identified by the Division, are commonly referred to as Tier 2 waters. Other surface waters not specifically identified and/or designated as high quality are referred to as Tier 1 waters. Some Tier 1 waters may be identified by the Division as not meeting existing criteria and appear on a list of impaired waters per Section 303(d) of the Clean Water Act.

The division has made a stream tier determination of the receiving waters associated with the subject discharge(s) and has found the receiving stream to be neither a Tier 2 nor Tier 3 water. Additionally, Woods Reservoir, Rollins and Rowland Creek (WB ID TN06030003036 – 1000) do appear on the 303(d) list, but only as a result of historic sediment contamination by PCBs. Current and proposed AEDC facility discharges do not contain any amounts of PCBs, and as such can not increase sediment load or cause any further degradation of surface streams. The department has maintained, and shall continue to assess, the water quality of the stream to assure that the water quality is adequate to protect the existing uses of the stream fully, and to assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources and all cost-effective and reasonable best management practices for nonpoint source control.

X. PERMIT DURATION

The proposed limitations meet the requirements of Section 301(b)(2)(A), (C), (D), (E), and (F) of the Clean Water Act as amended. It is the intent of the Division to organize the future issuance and expiration of this particular permit such that other permits located in the same watershed and group within the State of Tennessee will be set for issuance and expiration at the same time. In order to meet the target reissuance date for the Elk-Upper watershed and following the directives for the Watershed Management Program initiated in January, 1996, the permit will be issued for a 4 year term.

APPENDIX 1

FACILITY DISCHARGES AND RECEIVING WATERS

FACILITY DISCHARGES AND RECEIVING WATERS

OUTFALL 001	
LONGITUDE	LATITUDE
86-03-30	35-22-15

FLOW (MGD)	DISCHARGE SOURCE
0.2690	Sanitary wastewater from STP (01A)
0.1000	ASTF air stripper (01B)
0.1000	AC&T air stripper (01E)
0.0600	Site 1 Groundwater Treatment Unit (01C)
0.3000	Site 22 Ground Water Treatment Unit (01D)
0.2000	Domestic potable water uses
1.0E-06	Photo lab
0.0700	Metal parts rinse tank effluent
0.5400	Oil/water separators
1.0E-06	Test cell cleaning
0.0200	Glycol Reboiler condensate
5.0000	VKF cooling water
0.0400	Water Treatment Plant backwash
28.0000	Turbine ETF cooling water
0.0500	Solid & Liquid Rocket ETF & APTU cooling water
1.0E-06	Misc. cleaning operations
9.0000	ASTF cooling water
0.6000	G-range cooling water
0.0100	Site 8 Ground Water Treatment Unit (01a)
0.1000	Cooling tower blowdown
0.5000	PWT Cooling Water
0.1500	Mark I Cooling water
0.0007	PWT Reverse osmosis discharge
varies	Storm water runoff (total drainage area - 320 ac.)
45.1097	**TOTAL DISCHARGE**

RECEIVING STREAM DISCHARGE ROUTE
Unnamed tributary to Rowland Creek to Woods Reservoir

STREAM LOW FLOW	3Q20	1Q20	30Q2
(CFS)	0.0	NA	NA
(MGD)	0.0	NA	NA

STREAM USE CLASSIFICATIONS (WATER QUALITY)				
FISH	RECREATION	IRRIGATION	LW&W	DOMESTIC
X	X	X	X	
INDUSTRIAL	NAVIGATION			

Treatment

All wastestreams - sedimentation (Retention Pond)
STP - Grinding, screening, trickling filtration, aerobic digestion, drying beds, disinfection
WTP backwash - Rapid sand filtration, sedimentation
Groundwater Treatment Units - Counter-current air stripping
Oil/water separators - flotation
Glycol Reboiler condensate - distillation

APPENDIX 1

FACILITY DISCHARGES AND RECEIVING WATERS

FACILITY DISCHARGES AND RECEIVING WATERS

OUTFALL SW2	
LONGITUDE	LATITUDE
86-02-15	35-23-30

FLOW (MGD)	DISCHARGE SOURCE
1.2000	VKF cooling water
0.6000	G-Range cooling water
0.0100	Glycol Reboiler condensate
0.2000	Oil/water separators
0.0100	Site 8 Ground Water Treatment Unit
varies	Storm water runoff (Total drainage area - 200 ac.)
varies	TOTAL DISCHARGE

RECEIVING STREAM DISCHARGE ROUTE
Unnamed tributary to Bradley Creek to Woods Reservoir

STREAM LOW	3Q20	1Q20	30Q2
FLOW (CFS)	0.0	NA	NA
(MGD)	0.0	NA	NA

STREAM USE CLASSIFICATIONS (WATER QUALITY)				
FISH	RECREATION	IRRIGATION	LW&W	DOMESTIC
X	X	X	X	
INDUSTRIAL	NAVIGATION			

Note:
Process wastewater, nonprocess wastewater, and storm water runoff during small storm events is normally recycled.
Discharge through Outfall SW2 will only occur in response to large storm events.

Treatment
Glycol Reboiler condensate - distillation
Oil/water separators - flotation
Site 8 Groundwater Treatment Unit - distillation, carbon adsorption

APPENDIX 1

FACILITY DISCHARGES AND RECEIVING WATERS

FACILITY DISCHARGES AND RECEIVING WATERS

OUTFALL SW3	
LONGITUDE	LATITUDE
86-02-30	35-22-15

FLOW (MGD)	DISCHARGE SOURCE
0.1000	Cooling tower blowdown
0.5000	PWT cooling water
0.1500	Mark I cooling water
0.2000	Oil/water separators
0.0007	PWT RO discharge
varies	Storm water runoff (Total drainage area - 220 ac.)
varies	**TOTAL DISCHARGE**

RECEIVING STREAM DISCHARGE ROUTE
Unnamed tributary to Brumalow Creek to Woods Reservoir

STREAM LOW FLOW	3Q20	1Q20	30Q2
(CFS)	0.0	NA	NA
(MGD)	0.0	NA	NA

STREAM USE CLASSIFICATIONS (WATER QUALITY)				
FISH	RECREATION	IRRIGATION	LW&W	DOMESTIC
X	X	X	X	
INDUSTRIAL	NAVIGATION			

Note:
Process wastewater, nonprocess wastewater, and storm water runoff during small storm events is normally recycled. Discharge through Outfall SW3 will only occur in response to large storm events.

Treatment
Oil/water separators - flotation

FACILITY DISCHARGES AND RECEIVING WATERS

OUTFALL 004	
LONGITUDE	LATITUDE
86-03-45	35-19-30

FLOW (MGD)	DISCHARGE SOURCE
0.0210	Arnold Village STP
0.0210	**TOTAL DISCHARGE**

RECEIVING STREAM DISCHARGE ROUTE
Woods Reservoir

STREAM LOW FLOW	3Q20	1Q20	30Q2
(CFS)	NA	19.3	NA
(MGD)	NA	12.5	NA

STREAM USE CLASSIFICATIONS (WATER QUALITY)				
FISH	RECREATION	IRRIGATION	LW&W	DOMESTIC
X	X	X	X	X
INDUSTRIAL	NAVIGATION			
X				

Treatment
Arnold Village STP - Grinding, aerobic digestion, sedimentation, disinfection

APPENDIX 1

FACILITY DISCHARGES AND RECEIVING WATERS

FACILITY DISCHARGES AND RECEIVING WATERS

OUTFALL 005	
LONGITUDE	LATITUDE
86-00-00	35-22-15

FLOW (MGD)	DISCHARGE SOURCE
0.0350	Steam plant condensate
0.0120	Groundwater drainage
0.0400	Steam plant reverse osmosis
0.0250	Noncontact cooling water
0.1120	**TOTAL DISCHARGE**

RECEIVING STREAM DISCHARGE ROUTE
Unnamed tributary to Brumalow Creek to Woods Reservoir

STREAM LOW FLOW	3Q20	1Q20	30Q2
(CFS)	0.0	NA	NA
(MGD)	0.0	NA	NA

STREAM USE CLASSIFICATIONS (WATER QUALITY)				
FISH	RECREATION	IRRIGATION	LW&W	DOMESTIC
X	X	X	X	
INDUSTRIAL	NAVIGATION			

Treatment: None

FACILITY DISCHARGES AND RECEIVING WATERS

OUTFALL 006	
LONGITUDE	LATITUDE
86-08-45	35-20-45

FLOW (MGD)	DISCHARGE SOURCE
0.0200	Site 6 groundwater treatment unit
0.0200	**TOTAL DISCHARGE**

RECEIVING STREAM DISCHARGE ROUTE
Unnamed tributary to Spring Creek to Woods Reservoir

STREAM LOW FLOW	3Q20	1Q20	30Q2
(CFS)	0.0	NA	NA
(MGD)	0.0	NA	NA

STREAM USE CLASSIFICATIONS (WATER QUALITY)				
FISH	RECREATION	IRRIGATION	LW&W	DOMESTIC
X	X	X	X	
INDUSTRIAL	NAVIGATION			

Treatment
Site 6 Groundwater Treatment Unit - Counter-current air stripping

APPENDIX 1

FACILITY DISCHARGES AND RECEIVING WATERS

FACILITY DISCHARGES AND RECEIVING WATERS

OUTFALL 007	
LONGITUDE	LATITUDE
86-02-15	35-23-00

FLOW (MGD)	DISCHARGE SOURCE
0.0400	EAF Office Building HVAC discharge
0.0100	EAF Office Building groundwater drainage
0.0040	Non-industrial storm water
0.0540	TOTAL DISCHARGE

RECEIVING STREAM DISCHARGE ROUTE
Unnamed tributary to Bradley Creek to Woods Reservoir

STREAM LOW FLOW (CFS)	3Q20	1Q20	30Q2
	0.0	NA	NA
(MGD)	0.0	NA	NA

STREAM USE CLASSIFICATIONS (WATER QUALITY)				
FISH	RECREATION	IRRIGATION	LW&W	DOMESTIC
X	X	X	X	
INDUSTRIAL	NAVIGATION			

Treatment: None

FACILITY DISCHARGES AND RECEIVING WATERS

OUTFALL 008	
LONGITUDE	LATITUDE
86-04-15	35-19-15

FLOW (MGD)	DISCHARGE SOURCE
0.0070	Noncontact cooling water
0.000144	Non-industrial storm water
0.0071	TOTAL DISCHARGE

RECEIVING STREAM DISCHARGE ROUTE
Woods Reservoir

STREAM LOW FLOW (CFS)	3Q20	1Q20	30Q2
	NA	17.4	NA
(MGD)	NA	11.2	NA

STREAM USE CLASSIFICATIONS (WATER QUALITY)				
FISH	RECREATION	IRRIGATION	LW&W	DOMESTIC
X	X	X	X	X
INDUSTRIAL	NAVIGATION			
X				

Treatment: None

APPENDIX 2

PREVIOUS PERMIT LIMITS AND MONITORING REQUIREMENTS

PREVIOUS PERMIT LIMITS

Discharge 001

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS MONTHLY AVG. CONC. (mg/l)	EFFLUENT LIMITATIONS MONTHLY AVG. AMNT. (lb/day)	EFFLUENT LIMITATIONS DAILY MAX. CONC. (mg/l)	EFFLUENT LIMITATIONS DAILY MAX. AMNT. (lb/day)	MONITORING REQUIREMENTS MSRMNT. FRQNCY.	MONITORING REQUIREMENTS SAMPLE TYPE
FLOW	Report (MGD)		Report (MGD)		Continuous	Recorder
pH	Range 6.5 - 8.5				Continuous	Recorder
CBOD5	15.0	--	--	--	1/Week	Composite
Ammonia (as N)	1.1	--	--	--	1/Week	Composite
Ammonia (as N)	1.8	--	--	--	1/Week	Composite
Chloride	--	--	250	--	1/Month	Composite
Dissolved Oxygen	6.0 mg/l minimum				1/Week	Grab
PCBs (T) *	1.0×10^{-6}	--	--	--	**	Grab
Iron (T) ***	1.0	--	1.5	--	1/Week	Composite
Copper (T)	0.03	--	0.04	--	1/Week	Composite
Cadmium (T)	0.003	--	0.005	--	1/Week	Composite
Chromium (T)	0.10	--	0.20	--	1/Week	Composite
Lead (T)	0.0025	--	0.16	--	1/Week	Composite
Cyanide (T)	0.0035	--	0.005	--	1/Week	Grab
Oil & Grease	10.0	--	15.0	--	1/Week	Grab
Chlorine (T. Res.)	0.011	--	0.019	--	1/Week	Grab
Temperature	Maximum not to exceed 30.5 degrees C				Continuous	Recorder
96 Hr. LC50	Survival in 100% Effluent				****	Composite
NOEL	Survival, Reproduction, & Growth in 100% Effluent				****	Composite

* See Part III - Environmental Monitoring for specific requirements.

** Once within ninety (90) days of the effective date of this permit.

*** The concentration of the Water Treatment Plant Intake may be subtracted from the total and the resultant value reported as the "net" value for compliance with this permit.

**** See Part III for methodology and measurement frequency.

APPENDIX 2

PREVIOUS PERMIT LIMITS AND MONITORING REQUIREMENTS

PREVIOUS PERMIT LIMITS

Discharge 004

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS MONTHLY AVG. CONC. (mg/l)	MONTHLY AVG. AMNT. (lb/day)	DAILY MAX. CONC. (mg/l)	DAILY MAX. AMNT. (lb/day)	MONITORING REQUIREMENTS MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	Report (MGD)		Report (MGD)		2/Week	Estimate
pH	Range 6.0 - 9.0				2/Week	Grab
BOD5	30	--	45	--	1/Week	Composite
Ammonia (as N)	5.0	--	8.0	--	1/Week	Composite
TSS	30.0	--	45.0	--	1/Week	Composite
Fecal Coliform	200/100 ml	--	400/100 ml	--	1/Week	Grab
Dissolved Oxygen	1.0 mg/l minimum				5/Week	Grab
Chlorine (T. Res.)	--	--	0.5	--	2/Week	Grab
Settleable Solids	--	--	1.0 ml/l	--	2/Week	Grab

PREVIOUS PERMIT LIMITS

Internal Monitoring Point 01A
Main Sewage Treatment Plant Effluent

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS MONTHLY AVG. CONC. (mg/l)	MONTHLY AVG. AMNT. (lb/day)	DAILY MAX. CONC. (mg/l)	DAILY MAX. AMNT. (lb/day)	MONITORING REQUIREMENTS MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	Report (MGD)		Report (MGD)		Continuous	Recorder
pH	Range 6.0 - 9.0				5/Week	Grab
BOD5	30	--	45	--	3/Week	Composite
TSS	30	--	45	--	3/Week	Composite
Fecal Coliform	200/100 ml	--	400/100 ml	--	3/Week	Grab
Dissolved Oxygen	1.0 mg/l minimum				5/Week	Grab
Chlorine (T. Res.)	--	--	0.5	--	5/Week	Grab
Settleable Solids	--	--	1.0 ml/l	--	5/Week	Grab

APPENDIX 2

PREVIOUS PERMIT LIMITS AND MONITORING REQUIREMENTS

PREVIOUS PERMIT LIMITS

Internal Monitoring Points 01B, 01D, 01E, 02A, & 03A

J4/J5 Noncontact /Contact Cooling Water, APTU Contact Cooling Water, & Storm Water
01D - ETF Noncontact & Contact Cooling Water & ASTF Noncontact Cooling Water
01E - J6 Contact Cooling Water
02A - VKF Noncontact Cooling Water
03A - Cooling Tower Blowdown

	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
EFFLUENT CHARACTERISTIC	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	Report (MGD)		Report (MGD)		1/Week	Estimate
pH	Report (s. u.)				1/Week	Grab
Temperature	--	--	Report (degrees C)		1/Week	Grab

PREVIOUS PERMIT LIMITS

Internal Monitoring Point 01C
Water Treatment Plant Filter Backwash

	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
EFFLUENT CHARACTERISTIC	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	Report (MGD)		Report (MGD)		1/Month	Estimate
pH	Report (s.u.)				1/Month	Grab
TSS	--	--	Report	--	1/Month	Grab
Iron (T)	--	--	Report	--	1/Month	Grab
Settleable Solids	--	--	Report	--	1/Month	Grab

PREVIOUS PERMIT LIMITS

Internal Monitoring Point 01F
Treated Groundwater

	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
EFFLUENT CHARACTERISTIC	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	Report (MGD)		Report (MGD)		1/Month	Estimate
pH	Range 6.0 - 9.0				1/Month	Grab
Trichloroethylene	--	--	Report	--	1/Month	Grab
Toxicity Testing	--	--	--	--	*	*

* See Part III

APPENDIX 3

HISTORICAL MONITORING – SUMMARY OF EXCEEDANCES

Code Expansion for Parameter Code	Outfall	Monitorig Period	Avg Value	Max Value	Min Value
TOTAL RESIDUAL CHLORINE (TRC)	001	11/30/1998		**0.4**	
PH	001	07/31/2002		**8.6**	7.2
PH	001	12/31/1999		**8.6**	7.4
PH	001	07/31/2000		**8.6**	7.5
PH	001	06/30/1998		**8.7**	6.5
PH	001	05/31/2000		**8.7**	6.5
PH	001	01/31/2002		**8.7**	6.6
PH	001	07/31/2001		**8.7**	6.9
PH	001	05/31/1998		**8.7**	7.1
PH	001	08/31/2001		**8.7**	7.3
PH	001	12/31/2001		**8.8**	6.7
PH	001	06/30/2000		**8.8**	6.8
PH	001	06/30/2002		**8.8**	7.2
PH	001	03/31/2000		**8.9**	6.5
PH	001	04/30/2001		**8.9**	6.8
PH	001	05/31/2002		**8.9**	6.9
PH	001	05/31/2001		**8.9**	7.3
PH	001	06/30/2001		**8.9**	7.3
PH	001	03/31/2002		**9**	6.7
PH	001	04/30/2002		**9**	7.4
PH	001	02/28/2002		**9**	7.5
PH	001	03/31/2001		**9.1**	6.5
PH	001	01/31/2001		**9.1**	6.8
PH	001	02/28/2001		**9.2**	7.3
NOEL STATRE 7DAY CHR PIMEPHALES	WET 001	04/30/1998			**50**
NOEL STATRE 7DAY CHR PIMEPHALES	WET 001	06/30/1998			**50**
NITROGEN AMMONIA TOTAL (AS N)	004	05/31/1998	**7.7**	**13.9**	
NITROGEN AMMONIA TOTAL (AS N)	004	04/30/1998	**5.5**	**8.9**	
COLIFORM FECAL MF M-FC BROTH 44.5C	004	06/30/2002	170	**>400**	
NOEL STATRE 7DAY CHR PIMEPHALES	WET 001	04/30/1999			**67.7**
NOEL STATRE 7DAY CHR PIMEPHALES	WET 001	06/30/1999			**67.7**
LC50 STATRE 96HR ACU PIMEPHALES	WET 001	04/30/1999			**74.55**
LC50 STATRE 96HR ACU PIMEPHALES	WET 001	06/30/1999			**74.55**
NOEL STATRE 7DAY CHR PIMEPHALES	WET 001	10/31/2000			**82.3**
NOEL STATRE 7DAY CHR PIMEPHALES	WET 001	12/31/2000			**82.3**
LC50 STATRE 96HR ACU PIMEPHALES	WET 001	10/31/2000			**94.6**
LC50 STATRE 96HR ACU PIMEPHALES	WET 001	12/31/2000			**94.6**
NOEL STATRE 7DAY CHR CERIODAPHNIA	WET 001	04/30/2000			**95.5**
NOEL STATRE 7DAY CHR PIMEPHALES	WET 001	06/30/2000			**95.5**

APPENDIX 4a

NEW PERMIT LIMITS AND MONITORING REQUIREMENTS

Water Quality Based Effluent Calculations

WATER QUALITY BASED EFFLUENT CALC. OUTFALL 001

FACILITY Arnold Engineering Development Center
PERMIT # TN0003751

Stream (7Q10) [MGD]	Stream (30Q2) [MGD]	Waste Flow [MGD]	Ttl. Susp. Solids [mg/l]	Hardness (as CaCO3) [mg/l]	Stream Allocation [%]
0.000	0.000	45.110	16.75	90	100

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Stream	Fish/Aqua. Life		Effluent	Fish & Aquatic Life Water Quality Criteria (7Q10)				Human Health Water Quality Criteria (30Q2)					
	Bckgrnd.	Water Quality Criteria		Fraction	In-Stream Allowable		Calc. Eff. Conc.		In-Stream Criteria			Calc. Effluent Concentration		
EFFLUENT	Conc.	Chronic	Acute	Dissolved	Chronic	Acute	Chronic	Acute	Organisms	Water/Org	DWS	Organisms	Water/Org	DWS
CHARACTERISTIC	[ug/l]	[ug/l]	[ug/l]	[Fraction]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]
Cadmium *	1.8	0.954	3.303	0.265	3.593	12.444	3.6	12.4	NA	NA	NA	NA	NA	NA
Copper *	16.3	10.374	15.408	0.318	32.597	48.416	32.6	48.4	NA	NA	NA	NA	NA	NA
Lead *	6.6	2.243	57.571	0.169	13.281	340.820	13.3	340.8	NA	NA	NA	NA	NA	NA
Nickel *	189.6	143.787	1294.703	0.379	379.247	3414.856	379.2	3414.9	4,600	NA	NA	4,600	NA	NA
Silver *	0.0	NA	2.878	1.000	NA	2.878	NA	2.9	NA	NA	NA	NA	NA	NA
Zinc *	185.5	95.583	104.673	0.258	370.905	406.181	370.9	406.2	NA	NA	NA	NA	NA	NA
Chromium (T) **	50.0	100.000	NA	1.000	100.000	N/A	100.0	NA	NA	NA	NA	NA	NA	NA
Cyanide	2.6	5.200	22.000	1.000	5.200	22.000	5.2	22.0	2.E+05	NA	NA	2.E+05	NA	NA
Selenum (T)	2.5	5.000	20.000	1.000	5.000	20.000	5.0	20.0	NA	NA	NA	NA	NA	NA
Aluminum	43.5	87.000	750.000	1.000	87.000	750.000	87.0	750.0	NA	NA	NA	NA	NA	NA
1,1,1 Trichloroethane	0.0	NA	NA	1.000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	0.0	NA	NA	1.000	NA	NA	NA	NA	4,300	NA	NA	4,300	NA	NA
Chloride	115000.0	230,000	860,000	1.000	230,000	860,000	230000	860000	44	NA	NA	44	NA	NA
Ammonia (as N)	0.6	1.290	2.580	1.000	1.290	2.580	1.290	2.580	NA	NA	NA	NA	NA	NA
Tetrachloroethylene	0.0	NA	NA	1.000	NA	NA	NA	NA	88.5	NA	NA	88.5	NA	NA
Trichloroethylene	0.0	NA	NA	1.000	NA	NA	NA	NA	810	NA	NA	810	NA	NA
1,1-Dichloroethylene	0.0	NA	NA	1.000	NA	NA	NA	NA	32.0	NA	NA	32.0	NA	NA
1,2-Dichlorobenzene	0.0	NA	NA	1.000	NA	NA	NA	NA	17,000	NA	NA	2.E+04	NA	NA
1,3-Dichlorobenzene	0.0	NA	NA	1.000	NA	NA	NA	NA	2,600	NA	NA	2,600	NA	NA
Chlorine (T. Res.)	5.5	11.000	19.000	1.000	11.000	19.000	11.0	19.0	NA	NA	NA	NA	NA	NA

* Denotes metals for which Fish & Aquatic Life Criteria are expressed as a function of total hardness.
The Fish & Aquatic Life criteria for this metal are in the dissolved form at laboratory conditions.
The in-stream allowable criteria and calculated effluent concentrations are in the total recoverable form.

** The criteria for this parameter are in the total recoverable form.

NOTE: Water Quality criteria for stream use classifications other than Fish & Aquatic Life are based on the 30Q2 flow.

APPENDIX 4b

Determination of Monitored Effluent Characteristics

DETERMINATION OF MONITORED EFFLUENT CHARACTERISTICS

Arnold Engineering Development Center
Outfall 001

EFFLUENT CHARACTERISTIC	RDL *	Application Sample		Tennessee Rules	Water Quality	Selected for Monitoring?	Comment
		Long Term Average	Daily Maximum				
	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]		
CHROMIUM (T)	0.001	<0.01	<0.01	3	0.1	Yes	Reduced frequency
COPPER (T)	0.001	0.0007	0.012	1	0.0326	Yes	Reduced frequency
LEAD (T)	0.001	0.0011	0.012	0.1	0.013	Yes	
NICKEL (T)	0.01	--	0.0028	3	0.379	No	
SELENIUM	0.002	--	0.006	0.01	0.005	Yes	Added
SILVER (T)	0.001	--	<0.003	0.05	0.0029	Yes	Added
ZINC (T)	0.001	--	0.0089	2	0.371	No	
ALUMINUM (T)	--	--	0.749	250	0.087	No	See Rationale, p.8
IRON (T)	--	0.900	5.100	10	NPC **	No	
CHLORINE (T. Res.)	0.05	<0.01	<0.01	2	0.011	No	Replaced by UV
OIL & GREASE	--	<0.05	<5	15	--	Yes	Reduced frequency
PHOSPHORUS (T)	--	--	0.094	--	--	No	
SULFATE	--	--	9.00	--	--	No	
MANGANESE	--	--	0.115	10	--	No	
BERYLLIUM	0.001	--	<0.00111	1	--	No	
CADMIUM	0.001	<0.01	<0.01	0.01	0.003	Yes	
1,1-DICHLOROETHANE	--	--	<0.001	--	--	No	
1,1-DICHLOROETHYLENE	0.001	--	<0.001	--	0.032	No	
1,2-DICHLOROBENZENE	0.002	--	<0.001	--	17	No	
1,3-DICHLOROBENZENE	0.002	--	<0.001	--	2.6	No	
TETRACHLOETHYLENE	0.0005	--	<0.001	--	0.0885	No	
1,1,1-TRICHLOROETHANE	0.001	--	<0.001	--	--	No	
TRICHLOROETHYLENE	0.001	--	<0.001	--	0.81	No	
BOD5/CBOD5	--	--	<5.0***	45***	15.0****	Yes	
TSS	--	11.0	23.0	40	--	Yes	
DISSOLVED OXYGEN	--	--	--	--	6.0 min.	Yes	
AMMONIA (as N)	--	0.050	0.390	--	1.1	Yes	

* Required Detection Level per State of Tennessee Rule 1200-4-3-.05(8)
** No promulgated State of Tennessee numerical water quality criteria.
*** BOD5
**** CBOD5

APPENDIX 4b

Comparison of Discharge Limitations

DETERMINATION OF DISCHARGE LIMITATIONS

Arnold Engineering Development Center
Outfall 001

EFFLUENT CHARACTERISTIC	Monthly Average				Daily Maximum			
	Effluent Guidelines	Previous Permit	Water Quality	New Permit	Effluent Guidelines	Previous Permit	Water Quality	New Permit
	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]
pH	6.0-9.0	6.5-8.5	6.5-9.0	**6.5-9.0**	6.0-9.0	6.5-8.5	6.5-9.0	**6.5-9.0**
TSS	--	Report	--	**Report**	40.0	Report	--	**Report****
OIL & GREASE	10.0	10.0	--	**10.0**	15.0	15.0	--	**15.0**
CBOD5	--	15.0	15.0	**15.0**	--	25.0	25.0 *	**25.0**
AMMONIA (as N)	--	1.1	1.1	**1.1**	--	2.2	2.2 *	**2.2**
CADMIUM (T)	--	0.003	0.0036	**0.003**	0.01	0.005	0.0124	**0.005**
CHROMIUM (T)	--	0.1	0.1	**0.1**	3.0	0.2	--	**0.2**
COPPER (T)	--	0.03	0.0326	**0.03**	1.0	0.04	0.0484	**0.04**
SELENIUM	--	--	0.005	**0.005**	0.01	--	0.02	**0.01**
SILVER (T)	--	--	NA	**NA**	0.05	--	0.0029	**0.003**
LEAD (T)	--	0.0025	0.0133	**0.013 ****	0.1	0.16	0.3408	**0.1**
CHLORINE (T. Res.)	--	0.011	0.011	**0.011**	2.0	0.019	0.019	**0.019**
DISSOLVED OXYGEN	--	6.0 min.	6.0 min.	**6.0 min**	--	6.0 min.	6.0 min.	**6.0 min**

* Based on Best Professional Judgment of the permit writer.
** See rationale, pages 8-10

APPENDIX 4c

New Permit Limits

PERMIT LIMITS

Outfall 001
Process Wastewater, Nonprocess Wastewater, Sanitary Wastewater, & Storm Water Runoff

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS MONTHLY AVG. CONC. (mg/l)	MONTHLY AVG. AMNT. (lb/day)	DAILY MAX. CONC. (mg/l)	DAILY MAX. AMNT. (lb/day)	MONITORING REQUIREMENTS MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	Report (MGD) (1)		Report (MGD) (1)		Continuous	Recorder
pH (2)	Range 6.5 - 9.0				Continuous	Recorder
CBOD5	15.0	--	25.0	--	1/Week	Composite
NITROGEN, AMMONIA TOTAL	1.1	--	2.2	--	1/Week	Composite
DISSOLVED OXYGEN (D.O.)	6.0 mg/l minimum				1/Week	Grab
TSS (Influent) (3)	Report	--	Report	--	1/Month	Composite
TDS (Influent) (3)	Report	--	Report	--	1/Month	Composite
TSS (Effluent)	Report	--	Report	--	1/Month	Composite
TDS (Effluent)	Report	--	Report	--	1/Month	Composite
Oil & Grease	10.0	--	15.0	--	1/Month	Grab
COPPER, Total	0.03	--	0.04	--	1/Month	Composite
CADMIUM, Total	0.003	--	0.005	--	1/Week	Composite
CHROMIUM, Total	0.10	--	0.20	--	1/Month	Composite
LEAD, Total	0.01	--	0.10	--	1/Week	Composite
SELENIUM, TOTAL	0.005	--	0.010	--	1/Week	Composite
SILVER, TOTAL	--	--	0.003	--	1/Month	Composite
CHLORINE, TOTAL RESIDUAL (TRC)	0.011 (4)	--	0.019 (4)	--	1/Week	Grab
TEMPERATURE, Effluent	Report effluent temperature (° C)				Continuous	Recorder
IC25	Survival, Reproduction, & Growth in 100% Effluent				Semi-annual	Composite (5)

(1) Flow shall be reported in Million Gallons per Day (MGD)
(2) Analyses shall be performed within 15 minutes following sample collection.
(3) The sample shall be representative of the intake water from Woods Reservoir.
(4) The acceptable methods for detection of total residual chlorine are any methods specified in 40 CFR Part 136 that reach a detection level allowing accurate evaluation of compliance with the permit limits. The required analytical quantitation level for TRC is the permit limit or 0.05 mg/L, whichever is lower. In cases where there appears to be matrix interferences, and the permit limit is less than 0.05, the permittee may request approval for using 0.05 mg/L as the analytical quantitation level that shall be used for compliance evaluations. A quantitation level other than 0.05 mg/L may be appropriate, but the permittee will not be approved to use it without supporting data for the wastewater in question. A request to use >0.05 mg/L or an alternate compliance evaluation detection level must be submitted to the regional TN Environmental Assistance Center and to the Enforcement and Compliance Section. Use of any detection level higher than the permit limits for evaluating compliance shall not be done without prior approval from the Division.
(5) See Part III for methodology.

APPENDIX 4

New Permit Limits

PERMIT LIMITS

Wet Weather Discharges

Outfalls SW 2 and SW3 discharge only to response to exceptionally large storm events that exceed the pumping station capacity.

Outfall SW2
Nonprocess Wastewater, Remediated Groundwater, & Storm Water Runoff

Outfall SW3
Nonprocess Wastewater & Storm Water Runoff

	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
EFFLUENT CHARACTERISTIC	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE *
FLOW	--	--	Report (MGD) **		Semi-annual	Recorder
pH ***	Report				Semi-annual	Grab
BOD5	--	--	Report	--	Semi-annual	Grab
COD	--	--	Report	--	Semi-annual	Grab
TOTAL SUSPENDED SOLIDS (TSS)	--	--	Report	--	Semi-annual	Grab
OIL & GREASE	--	--	Report	--	Semi-annual	Grab

* Sample collected during a Qualifying Storm Event.

** Flow shall be reported in Million Gallons per Day (MGD)

*** pH analyses shall be performed within 15 minutes following sample collection.

APPENDIX 4c

New Permit Limits

PERMIT LIMITS

Outfall 004
Arnold Village STP

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS: MONTHLY AVG. CONC. (mg/l)	MONTHLY AVG. AMNT. (lb/day)	DAILY MAX. CONC. (mg/l)	DAILY MAX. AMNT. (lb/day)	MONITORING REQUIREMENTS: MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	Report (MGD) *		Report (MGD) *		5/Week	Instantaneous
pH **	Range 6.0 - 9.0				5/Week	Grab
BOD5	30	--	45	--	2/Month	Composite
NITROGEN, AMMONIA TOTAL	5.0	--	8.0	--	2/Month	Composite
TOTAL SUSPENDED SOLIDS (TSS)	30	--	45	--	2/Month	Composite
FECAL COLIFORM ***	200/100 mL	--	400/100 mL	--	2/Month	Grab
E. Coli ***	--	--	126/100 mL	--	3/Week	Grab
DISSOLVED OXYGEN (D.O.)	1.0 mg/l minimum				5/Week	Grab
CHLORINE, TOTAL RESIDUAL (TRC)	--	--	0.5	--	2/Week	Grab
SOLIDS, SETTLEABLE	--	--	1.0 mL/L	--	2/Week	Grab

* Flow shall be reported in Million Gallons per Day (MGD)

** pH analyses shall be performed within 15 minutes following sample collection.

*** The wastewater discharge must be disinfected to the extent that viable coliform organisms are effectively eliminated. The concentration of the fecal coliform group after disinfection shall not exceed 200 per 100 ml, nor shall the E. coli concentration exceed 126 per 100 ml as the geometric mean based on a minimum of 10 samples, collected from a given sampling site over a period of not more than 30 consecutive days with individual samples being collected at intervals of not less than 12 hours. For the purpose of determining the geometric mean, individual samples having a fecal coliform or E. coli group concentration of less than one (1) per 100 ml shall be considered as having a concentration of one (1) per 100 ml. In addition, the concentration of the fecal coliform group in any individual sample shall not exceed 1,000 per 100 ml. In the absence of a method in 40 CFR, Part 136 for measuring E. coli in effluent matrices, the permittee shall use methods proposed or added to Part 136 for measuring E. coli in ambient water.

APPENDIX 4c

New Permit Limits

PERMIT LIMITS

Internal Monitoring Point 01A
Main Sewage Treatment Plant Effluent

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	Report (MGD) *		Report (MGD) *		Continuous	Recorder
pH **	Range 6.0 - 9.0				5/Week	Grab
BOD5	30	--	45	--	3/Week	Composite
TOTAL SUSPENDED SOLIDS (TSS)	30	--	45	--	3/Week	Composite
FECAL COLIFORM ***	200/100 mL	--	400/100 mL	--	3/Week	Grab
E. Coli ***	--	--	126/100 mL	--	3/Week	Grab
SOLIDS, SETTLEABLE	--	--	1.0 mL/L	--	5/Week	Grab

* Flow shall be reported in Million Gallons per Day (MGD)

** pH analyses shall be performed within 15 minutes following sample collection.

*** The wastewater discharge must be disinfected to the extent that viable coliform organisms are effectively eliminated. The concentration of the fecal coliform group after disinfection shall not exceed 200 per 100 ml, nor shall the E. coli concentration exceed 126 per 100 ml as the geometric mean based on a minimum of 10 samples, collected from a given sampling site over a period of not more than 30 consecutive days with individual samples being collected at intervals of not less than 12 hours. For the purpose of determining the geometric mean, individual samples having a fecal coliform or E. coli group concentration of less than one (1) per 100 ml shall be considered as having a concentration of one (1) per 100 ml. In addition, the concentration of the fecal coliform group in any individual sample shall not exceed 1,000 per 100 ml. In the absence of a method in 40 CFR, Part 136 for measuring E. coli in effluent matrices, the permittee shall use methods proposed or added to Part 136 for measuring E. coli in ambient water.

APPENDIX 4c

New Permit Limits

PERMIT LIMITS

Internal Monitoring Point 01B (to Outfall 001)
Treated Groundwater - ASTF

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	--	--	Report (MGD) *		1/Quarter	Estimate
pH **	Report				1/Quarter	Grab
TRICHLORETHENE	--	--	Report	--	1/Quarter	Grab

* Flow shall be reported in Million Gallons per Day (MGD)
** pH analyses shall be performed within 15 minutes following sample collection.

PERMIT LIMITS

Internal Monitoring Point 01C (to Outfall 001)
Site 1 Remediated Groundwater

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	--	--	Report (MGD) *		1/Quarter	Estimate
pH **	Report				1/Quarter	Grab
1,1-DICHLOROETHENE	--	--	Report	--	1/Quarter	Grab
1,1,1-TRICHLOROETHANE	--	--	Report	--	1/Quarter	Grab
TRICHLORETHENE	--	--	Report	--	1/Quarter	Grab
TETRACHLOROETHENE	--	--	Report	--	1/Quarter	Grab

* Flow shall be reported in Million Gallons per Day (MGD)
** pH analyses shall be performed within 15 minutes following sample collection.

APPENDIX 4c

New Permit Limits

PERMIT LIMITS

Internal Monitoring Point 01D (to Outfall 001)
Site 22 Remediated Groundwater

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	--	--	Report (MGD) *		1/Quarter	Estimate
pH **	Report				1/Quarter	Grab
1,1-DICHLOROETHENE	--	--	Report	--	1/Quarter	Grab
1,1,1-TRICHLOROETHANE	--	--	Report	--	1/Quarter	Grab
TRICHLORETHENE	--	--	Report	--	1/Quarter	Grab
TETRACHLOROETHENE	--	--	Report	--	1/Quarter	Grab

* Flow shall be reported in Million Gallons per Day (MGD)
** pH analyses shall be performed within 15 minutes following sample collection.

PERMIT LIMITS

Internal Monitoring Point 01E (to Outfall 001)
AC&T Site Remediated Groundwater

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	--	--	Report (MGD) *		1/Quarter	Estimate
pH **	Report				1/Quarter	Grab
1,1-DICHLOROETHENE	--	--	Report	--	1/Quarter	Grab
1,1,1-TRICHLOROETHANE	--	--	Report	--	1/Quarter	Grab
TRICHLORETHENE	--	--	Report	--	1/Quarter	Grab
TETRACHLOROETHENE	--	--	Report	--	1/Quarter	Grab

* Flow shall be reported in Million Gallons per Day (MGD)
** pH analyses shall be performed within 15 minutes following sample collection.

APPENDIX 4c

New Permit Limits

PERMIT LIMITS

Internal Monitoring Point 02A (to Outfall 001)
Site 8 Remediated Groundwater

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	Report (MGD) *		Report (MGD) *		1/Quarter	Estimate
pH **	Report				1/Quarter	Grab
1,1,1-TRICHLOROETHANE	--	--	Report	--	1/Quarter	Grab
TETRACHLOROETHENE	--	--	Report	--	1/Quarter	Grab

* Flow shall be reported in Million Gallons per Day (MGD)
** pH analyses shall be performed within 15 minutes following sample collection.

PERMIT LIMITS

Outfall 005
Steam Plant Condensate and Steam Plant Reverse Osmosis Wastewater,
Noncontact Cooling Water, Groundwater Drainage

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	--	--	Report (MGD) *		1/Month	Estimate
pH **	Range 6.5 - 9.0				1/Month	Grab
OIL & GREASE	--	--	Report	--	1/Quarter	Grab
TEMPERATURE, Effluent	Report effluent temperature (°C)				1/Month	Grab

* Flow shall be reported in Million Gallons per Day (MGD)
** pH analyses shall be performed within 15 minutes following sample collection.

APPENDIX 4c

New Permit Limits

PERMIT LIMITS

Outfall 006
Site 6 Remediated Groundwater

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS MONTHLY AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	DAILY MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MONITORING REQUIREMENTS MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	Report (MGD) *		Report (MGD) *		1/Quarter	Estimate
pH **	Range 6.5 - 9.0				1/Quarter	Grab
1,1-DICHLOROETHENE	--	--	0.005	--	1/Quarter	Grab
METHYLENE CHLORIDE	--	--	0.025	--	1/Quarter	Grab

* Flow shall be reported in Million Gallons per Day (MGD)
** pH analyses shall be performed within 15 minutes following sample collection.

PERMIT LIMITS

Outfall 007
Building HVAC Discharge, Building Groundwater Drainage, Non-Industrial Storm Water

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS MONTHLY AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	DAILY MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MONITORING REQUIREMENTS MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	--	--	Report (MGD) *		1/Month	Estimate
pH **	Range 6.5 - 9.0				1/Month	Grab

* Flow shall be reported in Million Gallons per Day (MGD)
** pH analyses shall be performed within 15 minutes following sample collection.

PERMIT LIMITS

Outfall 008
Noncontact Cooling Water, Non-Industrial Storm Water

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS MONTHLY AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	DAILY MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MONITORING REQUIREMENTS MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	--	--	Report (MGD) *		1/Quarter	Estimate
pH **	Range 6.0 - 9.0				1/Quarter	Grab
TEMPERATURE, Effluent	Report effluent temperature (°C)				1/Quarter	Grab

* Flow shall be reported in Million Gallons per Day (MGD)
** pH analyses shall be performed within 15 minutes following sample collection.

REQUIREMENTS FOR MAKING A PERMIT APPEAL

Permit Appeal (Tennessee Department of Conservation, Chapter 1200-4-1.05(6), and T.C.A. Section 69-3-110)

1. Petitions must be made within 30 days of the receipt of the final permit.

2. Petitions shall contain the following:

   (a) The name, mailing address, and telephone number of the person mailing the request and the names and addresses of all persons he or she represents;

   (b) A clear and concise statement of each legal or factual matter alleged to be issue; and

   (c) Specific reference to each permit condition which the petitioner contests. The petitioner may suggest alternate permit terms which would meet the requirements of the Water Quality Control Act; if the petitioner challenges permit conditions which are justified in the fact sheet (or Rationale), the petitioner should indicate how the basis for the permit condition is in error or indicate why an alternate condition is necessary.

3. Petitions should be addressed to the Water Quality Control Board and filed in duplicate at the following address: Paul E. Davis, Director; Division of Water Pollution Control; Department of Environment and Conservation; 401 Church Street; L&C Annex, Sixth Floor; Nashville, Tennessee 37243-1534.

4. The appeal of a permit or a permit condition has the effect of staying the contested provisions. Therefore, if a permit is being reissued, the permittee will be considered to be authorized under the terms of the old permit and/or any unappealed terms of the reissued permit. If it is a new permit, the applicant will be considered to be without a permit for the activity until final agency action.

E8060092-D4WPC1

STATE OF TENNESSEE

NPDES PERMIT

Tracking No. TNR053036

General NPDES Permit for

STORM WATER DISCHARGES ASSOCIATED WITH INDUSTRIAL ACTIVITY

Effective February 1, 2002, through December 31, 2006

Tennessee Department of Environment and Conservation
Division of Water Pollution Control
401 Church Street
6th Floor, L&C Annex
Nashville, Tennessee 37243-1534

Under authority of the Tennessee Water Quality Control Act of 1977 (T.C.A. 69-3-101 et seq.) and the delegation of authority from the United States Environmental Protection Agency under the Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977 (33 U.S.C. 1251, et seq.):

Discharger: **Arnold Engineering Development Center**

is authorized to discharge: storm water associated with industrial activity

from a facility located: in **Arnold Afb, Franklin County**

to receiving waters named: **Outfall MS1 is a wet weather conveyance located 219' north from Crumpton Creek at mile marker 8.8**
Outfall MS2 is a wet weather conveyance located 840' north from Crumpton Creek at mile marker 8.5

in accordance with effluent limitations, monitoring requirements and other conditions set forth herein.

Coverage under this general permit shall become effective on **November 15, 2001,** and shall expire on **December 31, 2006.**

Notice of Coverage Issuance date: **February 12, 2002**

Paul E. Davis, Director
Division of Water Pollution Control

Applicable Sector(s): L
TMSP Requirements and Sectors are located at **http://www.state.tn.us/environment/permits/tmsp.htm**

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
Division of Water Pollution Control
Sixth Floor – L & C Annex
401 Church Street
Nashville, TN 37243-1534

MR. CHARLES KING

TMSP Tracking Number TNR053036

ARNOLD ENGINEERING DEVELOPMENT CENTER
1100 KINDEL DRIVE
ARNOLD AFB, TN 37389-1806

Tennessee Multi-Sector Permit (TMSP)
Notice of Coverage Fact Sheet

The Division of Water Pollution Control's recently received from your company a Notice of Intent (NOI) to be covered under the Tennessee Storm Water Multi-Sector General NPDES Permit for discharges of Storm Water associated with Industrial Activities (TMSP). The new TMSP became effective on February 1, 2002, and expires on December 31, 2006. We have recorded your facility's information and are hereby notifying you that your facility is covered under this general permit.

Enclosed with this fact sheet you will find a Notice of Coverage with the permit tracking number, facility's name, address, receiving stream information and the applicable industry-specific sector(s) that apply to your facility. You will notice that we have not provided a printed copy of the TMSP. Instead, we ask you to visit our web site, located at: www.state.tn.us/environment/permits/strmh2o.htm.

At our web site, ou will be able to download general and sector-specific requirements, as well as permit rationale, Notice of Determination, TMSP guidance documents, links to relevant web sites, and a copy of a No Exposure Certification form. If you don't have access to Internet, or have other questions, please contact us at 1-888-891-TDEC or by E-mail at *Storm.Water@state.tn.us*.

Thank you for your time and assistance.

Sincerely,
Permit Section
Division of Water Pollution Control

L. Storm Water Discharges Associated With Industrial Activity From Landfills and Land Application Sites

1. Discharges Covered Under This Section.

a) Coverage. The requirements listed under this section shall apply to storm water discharges associated with industrial activity from waste disposal at landfills and land application sites that receive or have received industrial wastes. Landfill and land application operators that have storm water discharges from other types of industrial activities such as vehicle maintenance, truck washing, and/or recycling may be subject to additional requirements specified elsewhere in this permit:

SIC Code	Sector L: Landfills and Land Application Sites	Sampling Required?	Table Number
4953	Refuse Systems	Yes	L-1 or L-2

When an industrial facility, described by the above coverage provisions of this section, has industrial activities being conducted onsite that meet the description(s) of industrial activities in another section(s), that industrial facility shall comply with any and all applicable monitoring and pollution prevention plan requirements of the other section(s) in addition to all applicable requirements in this section. The monitoring and pollution prevention plan terms and conditions of this multi-sector permit are additive for industrial activities being conducted at the same industrial facility (co-located industrial activities). The operator of the facility shall determine which other monitoring and pollution prevention plan section(s) of this permit (if any) are applicable to the facility.

b) Limitations. Storm water discharges associated with industrial activities from inactive landfills and land application sites occurring on Federal lands where an operator cannot be identified are ineligible for coverage under this permit.

2. Special Conditions

Prohibition of Non-storm Water Discharges. In addition to the broad non-storm water prohibition in Part III.A of today's permit, the discharge of leachate, gas collection condensate, drained free liquids, contaminated ground water, laboratory wastewater, and contact washwater from washing truck and railcar exteriors and surface areas which have come in direct contact with solid waste at the landfill facility to waters of the State or a municipal separate storm sewer system is not authorized by this permit. Operators with such discharges must obtain coverage under a separate NPDES permit (other than this permit). Discharges from open dumps as defined under RCRA are also not authorized under this permit (e.g., leachate, runoff).

3. Storm Water Pollution Prevention Plan Requirements

Contents of Plan. The plan shall include, at a minimum, the following items:

Pollution Prevention Team. Each plan shall identify a specific individual or individuals within the facility organization as members of a storm water Pollution Prevention Team that are responsible for developing the storm water pollution prevention plan and assisting the facility or plant manager in its implementation, maintenance, and revision. The plan shall clearly identify the responsibilities of each team member. The activities and responsibilities of the team shall address all aspects of the facility's storm water pollution prevention plan.

Description of Potential Pollutant Sources. Each plan shall provide a description of potential sources which may reasonably be expected to add significant amounts of pollutant to storm water discharges or which may result in the discharge of pollutants during dry weather from separate storm sewers draining the facility. Each plan shall identify all activities and significant materials which may potentially be significant pollutant sources. Each plan shall include, at a minimum:

Drainage. A site map indicating an outline of the portions of the drainage area of each storm water outfall that are within the facility boundaries, each existing structural control measure to reduce pollutants in storm water runoff, surface water bodies, locations of active and closed landfill cells or trenches, locations of active and closed land application areas, locations of any known leachate springs or other areas where uncontrolled leachate may commingle with runoff, locations of any leachate collection and handling systems, locations where major spills or leaks identified under Part XI.L.3.a.(2)(c) (Spills and Leaks) of this permit have occurred, and locations of the following activities where such activities are exposed to precipitation: fueling station, vehicle and equipment maintenance and/or cleaning areas, and waste and other significant material loading/unloading and storage areas. The map must indicate the outfall locations and the types of discharges contained in the drainage areas of the outfalls.

For each area of the facility that generates storm water discharges associated with industrial activity with a reasonable potential for containing significant amounts of pollutants, a prediction of the direction of flow, and an identification of the types of pollutants which are likely to be present in storm water discharges associated with industrial activity. Factors to consider include the toxicity of chemicals; quantities of chemicals used, produced or discharged; the likelihood of contact with storm water; and the history of significant leaks or spills of toxic or hazardous pollutants. Flows with a significant potential for causing erosion shall be identified.

Inventory of Exposed Materials—An inventory of the types of materials handled at the site that potentially may be exposed to precipitation. Such inventory shall include a narrative description of significant materials that have been handled, treated, or disposed of in a manner to allow exposure to storm water between the time of 3 years prior to the date of the submission of a Notice of Intent (NOI) to be covered under this permit and the present; method and location of onsite storage or disposal; materials management practices employed to minimize contact of materials with storm water runoff between the time of 3 years prior to the date of submission of a Notice of Intent (NOI) to be covered under this permit and the present; the location and a description of existing structural and nonstructural control measures to reduce pollutants in storm water runoff; and a description of any treatment the storm water receives. The inventory of exposed materials shall include, but shall not be limited to the significant material management practices employed.

Spills and Leaks—A list of significant spills and significant leaks of toxic or hazardous pollutants that occurred at areas that are exposed to precipitation or that otherwise drain to a storm water conveyance at the facility after the date of 3 years prior to the date of the submission of a Notice of Intent (NOI) to be covered under this permit. Such list shall be updated as appropriate during the term of the permit.

implementation, maintenance, and revision. The plan shall clearly identify the responsibilities of each team member. The activities and responsibilities of the team shall address all aspects of the facility's storm water pollution prevention plan.

Description of Potential Pollutant Sources. Each plan shall provide a description of potential sources which may reasonably be expected to add significant amounts of pollutant to storm water discharges or which may result in the discharge of pollutants during dry weather from separate storm sewers draining the facility. Each plan shall identify all activities and significant materials which may potentially be significant pollutant sources. Each plan shall include, at a minimum:

Drainage. A site map indicating an outline of the portions of the drainage area of each storm water outfall that are within the facility boundaries, each existing structural control measure to reduce pollutants in storm water runoff, surface water bodies, locations of active and closed landfill cells or trenches, locations of active and closed land application areas, locations of any known leachate springs or other areas where uncontrolled leachate may commingle with runoff, locations of any leachate collection and handling systems, locations where major spills or leaks identified under Part XI.L.3.a.(2)(c) (Spills and Leaks) of this permit have occurred, and locations of the following activities where such activities are exposed to precipitation: fueling station, vehicle and equipment maintenance and/or cleaning areas, and waste and other significant material loading/unloading and storage areas. The map must indicate the outfall locations and the types of discharges contained in the drainage areas of the outfalls.

For each area of the facility that generates storm water discharges associated with industrial activity with a reasonable potential for containing significant amounts of pollutants, a prediction of the direction of flow, and an identification of the types of pollutants which are likely to be present in storm water discharges associated with industrial activity. Factors to consider include the toxicity of chemicals; quantities of chemicals used, produced or discharged; the likelihood of contact with storm water; and the history of significant leaks or spills of toxic or hazardous pollutants. Flows with a significant potential for causing erosion shall be identified.

Inventory of Exposed Materials—An inventory of the types of materials handled at the site that potentially may be exposed to precipitation. Such inventory shall include a narrative description of significant materials that have been handled, treated, or disposed of in a manner to allow exposure to storm water between the time of 3 years prior to the date of the submission of a Notice of Intent (NOI) to be covered under this permit and the present; method and location of onsite storage or disposal; materials management practices employed to minimize contact of materials with storm water runoff between the time of 3 years prior to the date of submission of a Notice of Intent (NOI) to be covered under this permit and the present; the location and a description of existing structural and nonstructural control measures to reduce pollutants in storm water runoff; and a description of any treatment the storm water receives. The inventory of exposed materials shall include, but shall not be limited to the significant material management practices employed.

Spills and Leaks—A list of significant spills and significant leaks of toxic or hazardous pollutants that occurred at areas that are exposed to precipitation or that otherwise drain to a storm water conveyance at the facility after the date of 3 years prior to the date of the submission of a Notice of Intent (NOI) to be covered under this permit. Such list shall be updated as appropriate during the term of the permit.

Sampling Data—A summary of existing discharge sampling data describing pollutants in storm water of sampling data collected during the term of this permit. Permittees shall also provide all available sampling data for leachate generated at the site.

Risk Identification and Summary of Potential Pollutant Sources—Include a narrative description of potential pollutant sources associated with any of the following, providing they occur at the facility: fertilizer, herbicide and pesticide application; earth/soil moving; waste hauling and loading/unloading; outdoor storage of significant materials including daily, interim and final cover material stockpiles as well as temporary waste storage areas; exposure of active and inactive landfill and land application areas; uncontrolled leachate flows; failure or leaks from leachate collection and treatment systems; haul roads; and vehicle tracking of sediments. The description shall specifically list any significant potential sources of pollutants at the site and for each potential source, any pollutant or pollutant parameter (e.g., biochemical oxygen demand, etc.) of concern shall be identified.

Measures and Controls. Each facility covered by this permit shall develop a description of storm water management controls appropriate for the facility, and implement such controls. The appropriateness and priorities of controls in a plan shall reflect identified potential sources of pollutants at the facility. The description of storm water management controls shall address the following minimum components, including a schedule for implementing such controls:

Good Housekeeping—Good housekeeping requires the maintenance of areas which may contribute pollutants to storm water discharges in a clean, orderly manner. Permittees shall consider providing protected materials storage areas for pesticides, herbicides, fertilizers, and other significant materials.

Preventive Maintenance—A preventive maintenance program shall involve timely inspection and maintenance of storm water management devices (e.g., cleaning oil/water separators, catch basins) as well as inspecting and testing facility equipment and systems to uncover conditions that could cause breakdowns or failures resulting in discharges of pollutants to surface waters, and ensuring appropriate maintenance of such equipment and systems.

Where applicable, permittees addressed by this section shall also: 1) maintain containers used for outdoor chemical and significant materials storage to prevent leaking or rupture; 2) maintain all elements of leachate collection and treatment systems to prevent commingling of leachate with storm water; and 3) maintain the integrity and effectiveness of any intermediate or final cover, including making repairs to the cover as necessary to minimize the effects of settlement, sinking, and erosion.

Spill Prevention and Response Procedures—Areas where potential spills which can contribute pollutants to storm water discharges can occur, and their accompanying drainage points shall be identified clearly in the storm water pollution prevention plan. Where appropriate, specifying material handling procedures, storage requirements, and use of equipment such as diversion valves in the plan should be considered. Procedures for cleaning up spills shall be identified in the plan and made available to the appropriate personnel. The necessary equipment to implement a clean up should be available to personnel.

Inspections—Qualified facility personnel shall be identified to inspect designated equipment and areas of the facility at appropriate internals specified in the plan.

For operating landfills and land application sites, inspections shall be conducted at least once every 7 days. Qualified personnel shall inspect areas of landfills that have not yet been finally stabilized, active land application areas, areas used for storage of materials/wastes that are exposed to precipitation, stabilization and structural control measures, leachate collection and treatment systems, and locations where equipment and waste trucks enter and exit the site. Where landfill areas have been finally stabilized and where land application has been completed, or during seasonal arid periods in arid areas (areas with an average annual rainfall of 0 to 10 inches) and semiarid areas (areas with an average annual rainfall of 10 to 20 inches), inspections will be conducted at least once every month. Erosion and sediment control measures shall be observed to ensure they are operating correctly.

For inactive landfills and land application sites, inspections shall be conducted at least quarterly, and qualified personnel shall inspect: landfill stabilization and structural erosion control measures and leachate collection and treatment systems, and all closed land application areas.

A set of tracking or follow-up procedures shall be used to ensure that appropriate actions are taken in response to the inspections. The pollution prevention plan shall be revised to address any problems found during inspections. Records of inspections shall be maintained.

Employee Training—Employee training programs shall inform personnel responsible for implementing activities identified in the storm water pollution prevention plan or otherwise responsible for storm water management at all levels of responsibility of the components and goals of the storm water pollution prevention plan. Training should address topics such as conducting inspections, spill response, good housekeeping, conducting inspections and material management practices. The pollution prevention plan shall identify periodic dates for such training.

Recordkeeping and Internal Reporting Procedures—A description of incidents (such as spills, or other discharges), along with other information describing the quality and quantity of storm water discharges shall be included in the plan required under this part. Inspections and maintenance activities shall be documented and records of such activities shall be incorporated into the plan. Landfill operators shall provide for a tracking system for the types of wastes disposed of in each cell or trench of a landfill. Land application site operators shall track the types and quantities of wastes applied in specific areas.

Non-storm Water Discharges

The plan shall include a certification that the discharge has been tested or evaluated for the presence of non-storm water discharges including leachate and vehicle wash waters. The certification shall include the identification of potential significant sources of non-storm water at the site, a description of the results of any test and/or evaluation for the presence of non-storm water discharges, the evaluation criteria or testing method used, the date of any testing and/or evaluation, and the onsite drainage points that were directly observed during the test. Certifications shall be signed in accordance with Part VII.G. of this permit. Such certification may not be feasible if the facility operating the storm water discharge associated with industrial activity does not have access to an outfall, manhole, or other point of access to the ultimate conduit which receives the discharge. In such cases, the source identification section of the storm water pollution prevention plan shall indicate why the certification required by this part was not feasible, along with the identification of potential significant sources of non-storm water at the site. A discharger that is unable to provide the certification required by this paragraph must notify the Division of Water Pollution Control in accordance with paragraph XI.L.3.a.(3)(g)(iii) (below).

Sources of non-storm water that are combined with storm water discharges associated with industrial activity must be identified in the plan. The plan shall identify and ensure the implementation of appropriate pollution prevention measures for the non-storm water component(s) of the discharge. Any non-storm water discharges that are not permitted under an individual NPDES permit should be brought to the attention of the Division's local Environmental Assistance Center (see list of EACs on page 11).

Failure to Certify—Any facility that is unable to provide the certification required (testing for non-storm water discharges), must notify the Division of Water Pollution Control by not later than 180 days after submitting an NOI to be covered by this permit. If the failure to certify is caused by the inability to perform adequate tests or evaluations, such notification shall describe: the procedure of any test conducted for the presence of non-storm water discharges; the results of such test or other relevant observations; potential sources of non-storm water discharges to the storm sewer; and why adequate tests for such storm sewers were not feasible. Non-storm water discharges to waters of the State which are not authorized by an NPDES permit are unlawful, and must be terminated.

Sediment and Erosion Control—The plan shall identify areas which, due to topography activities, or other factors, have a high potential for significant soil erosion, and identify structural, vegetative, and/or stabilization measures to be used to limit erosion.

Landfill operators shall provide for temporary stabilization of materials stockpiled for daily, intermediate and final cover. Stabilization practices to consider include, but are not limited to, temporary seeding, mulching, and placing geotextiles on the inactive portions of the stockpiles.

Landfill operators shall provide for temporary stabilization of inactive areas of the landfill which have an intermediate cover but no final cover.

Landfill operators shall provide for temporary stabilization of any landfill areas which have received a final cover until vegetation has established itself. Land application site operators shall also stabilize areas where waste application has been completed until vegetation has been established.

Management of Runoff—The plan shall also contain a narrative consideration of the appropriateness of traditional storm water management practices (practices other than those which control the generation or source(s) of pollutants) used to divert, infiltrate, reuse, or otherwise manage storm water runoff in a manner that reduces pollutants in storm water discharges from the site. The plan shall provide that measures that the permittee determines to be reasonable and appropriate shall be implemented and maintained. The potential of various sources at the facility to contribute pollutants to storm water discharges associated with industrial activity [see paragraph XI.L.3.a.(2) of this section (Description of Potential Pollutant Sources)] shall be considered when determining reasonable and appropriate measures. Appropriate measures may include: silt fences, earth dikes, gradient terraces, drainage swales, sediment traps, check dams, pipe slope drains, level spreaders, storm drain inlet protection, rock outlet protection, reinforced soil retaining systems, gabions and temporary or permanent sediment basins, or other equivalent measures. Structural practices should be placed on upland soils as practicable.

Comprehensive Site Compliance Evaluation. Qualified personnel shall conduct site compliance evaluations at appropriate intervals specified in the plan, but in no case less than once a year. Such evaluations shall provide:

Areas contributing to a storm water discharge associated with industrial activity at landfill and land application sites shall be visually inspected for evidence of, or the potential for, pollutants entering the drainage system. Measures to reduce pollutant loadings shall be evaluated to determine whether they are adequate and properly implemented in accordance with the terms of the permit or whether additional control measures are needed. Structural storm water management measures, sediment and erosion control measures, and other structural pollution prevention measures identified in the plan shall be observed to ensure that they are operating correctly. A visual inspection of equipment needed to implement the plan, such as spill response equipment, shall be made.

Based on the results of the evaluation, the description of potential pollutant sources identified in the plan in accordance with paragraph XI.L.3.a.(2) of this section (Description of Potential Pollutant Sources) and pollution prevention measures and controls identified in the plan in accordance with paragraph XI.L.3.a.(3) of this section (Measures and Controls) shall be revised as appropriate within 2 weeks of such evaluation and shall provide for implementation of any changes to the plan in timely manner, but in no case more than 12 weeks after the evaluation.

A report summarizing the scope of the evaluation, personnel making the evaluation, the date(s) of the evaluation, major observations relating to the implementation of the storm water pollution prevention plan for at least 3 years from the date of the evaluation. The report shall identify any incidents of noncompliance. Where a report does not identify any incidents of noncompliance, the report shall contain a certification that the facility is in compliance with the storm water pollution prevention plan and this permit. The report shall be signed in accordance with Part VII.G. (Signatory Requirements) of this permit.

Where compliance evaluation schedules overlap with inspections required under 3.a.(3)(d), the compliance evaluation may be conducted in place of one such inspection.

4. Numeric Effluent Limitations

In addition to the numeric effluent limitations described by Part V.B. of this permit, the following effluent limitations shall be met by existing and new contaminated storm water discharges from landfills which are subject to the requirements of 40 CFR Part 445 Subpart B.

As set forth at 40 CFR Part 445 Subpart B, these numeric limitations apply to contaminated storm water discharges from Municipal Solid Waste Landfills (MSWLFs) which have not been closed in accordance with 40 CFR 258.60, and contaminated storm water discharges from those landfills which are subject to the provisions of 40 CFR Part 257 except for discharges from any of facilities described in (a) through (d) below:
(a) landfills operated in conjunction with other industrial or commercial operations when the landfill only receives wastes generated by the industrial or commercial operation directly associated with the landfill;
(b) landfills operated in conjunction with other industrial or commercial operations when the landfill receives wastes generated by the industrial or commercial operation directly associated with the landfill and also receives other wastes provided the other wastes received for disposal are generated by a facility that is subject to the same provisions in 40 CFR Subchapter N as the industrial or commercial operation or the other wastes received are of similar nature to the wastes generated by the industrial or commercial operation;
(c) landfills operated in conjunction with Centralized Waste Treatment (CWT) facilities subject to 40 CFR Part 437 so long as the CWT facility commingles the landfill wastewater with other non-landfill

wastewater for discharge. A landfill directly associated with a CWT facility is subject to this part if the CWT facility discharges landfill wastewater separately from other CWT wastewater or commingles the wastewater from its landfill only with wastewater from other landfills; or
(d) landfills operated in conjunction with other industrial or commercial operations when the landfill receives wastes from public service activities so long as the company owning the landfill does not receive a fee or other remuneration for the disposal service.

The concentration of pollutants in storm water discharges shall not exceed the effluent limitations in Table L-1.

Table L-1.
Numeric Effluent Limitations for Landfills and Land Application Sites

Effluent Characteristics	Effluent Limitations (mg/L)	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed
Biochemical Oxygen Demand (BOD_5)	140	37
Total Suspended Solids (TSS)	88	27
Ammonia	10	4.9
Alpha Terpineol	0.033	0.016
Benzoic Acid	0.12	0.071
p-Cresol	0.025	0.014
Phenol	0.026	0.015
Zinc (Total)	0.20	0.11
pH	Within the range of 6.0 to 9.0	

5. Monitoring and Reporting Requirements

c) Analytical Monitoring Requirements.

During the term of this permit, permittees covered under this sector must monitor their storm water discharges associated with industrial activity at least **once per calendar year (annually),** except as provided in paragraphs 5.a.(3) (Sampling Waiver), 5.a.(4) (Representative Discharge), and 5.a.(5) (Alternative Certification). For SIC-specific breakdown of monitoring requirements and applicable Monitoring Requirements (listed below), see Table in Part 1 of this industrial sector (1. Discharges Covered Under This Section). Facilities must report in accordance with 5.b. (Reporting). In addition to the parameters listed in Table L-1 above and Table L-2 below, the permittee shall maintain a record of the date and duration (in hours) of the storm event(s) sampled; rainfall measurements or estimates (in inches) of the storm event that generated the sampled runoff; the duration between the storm event sampled and the end of the previous measurable (greater than 0.1 inch rainfall) storm event; and an estimate of the total volume (in gallons) of the discharge sampled.

Table L-2.
Monitoring Requirements for Landfills and Land Application Sites

Pollutants of Concern	Cut-Off Concentration	Sector Median Value * [mg/L]
Total Suspended Solids (TSS)[i]	200 mg/L	47
Total Recoverable Iron[ii]	5.0 mg/L	2.2
Total Recoverable Aluminum[iii]	0.75	1.37
Total Recoverable Magnesium[iii]	0.0636	5.35

* Sector Median Value is a pollutant concentration calculated from all sampling results provided from facilities classified in this sector during the previous permit term. By definition, a median is a statistical term identifying a number that divides numerically ordered data into two equal halves. In easier terms, the median is the middle piece of data when those data are placed in numerical order, or the average of the middle two if there is an even number of items. Therefore, median concentration(s) listed above represent a concentration value typical for and achieved by industries in this sector.
[i]Applicable to all landfill and land application sites.
[ii]Applicable to all facilities except Municipal Solid Waste Landfill areas closed in accordance with 40 CFR 258.60 requirements.
[iii]Applicable to Municipal Solid Waste Landfill areas closed in accordance with 40 CFR 258.60 requirements.

(1)Monitoring Periods. Landfill/land application sites shall monitor samples collected during any period of a calendar year, as long as the samples are representative of the quantity and quality of the storm water runoff being discharged from the facility.

(2) Sample Type. A minimum of one grab sample shall be taken. All such samples shall be collected from the discharge resulting from a storm event that is greater than 0.1 inches in magnitude and that occurs at least 72 hours from the previously measurable (greater than 0.1 inch rainfall) storm event. The required 72-hour storm event interval is waived where the preceding measurable storm event did not result in a measurable discharge from the facility. The required 72-hour storm event interval may also be waived where the permittee documents that less than a 72-hour interval is representative for local storm events during the season when sampling is being conducted. The grab sample shall be taken during the first 30 minutes of the discharge. If the collection of a grab sample during the first 30 minutes is impracticable, a grab sample can be taken during the first hour of the discharge, and the discharger shall submit with the monitoring report a description of why a grab sample during the first 30 minutes was impracticable. If storm water discharges associated with industrial activity commingle with process or nonprocess water, then where practicable, permittees must attempt to sample the storm water discharge before it mixes with the non-storm water discharge.

In addition, the permittee shall evaluate the results obtained from sampling and monitoring following the required annual sampling events to determine whether the facility is below, meets, or exceeds the monitoring cut-off concentrations as shown in the Table above. If the results of annual storm water runoff monitoring demonstrate that the facility has exceeded the cut-off concentration(s), the permittee must inform the Division's local Environmental Assistance Center in writing within 30 days from the time SW monitoring results were received, describing the likely cause of the exceedance(s). Furthermore, within 60 days from the time SW monitoring results were received, the facility must review its storm water pollution prevention plan, make any modifications or additions to the plan which would assist in reducing effluent concentrations to less than the monitoring cut-off concentrations for that facility, and submit to the Division's local Environmental Assistance Center a brief summary of the proposed SWPPP modifications (including a timetable for implementation).

(3) Sampling Waiver

(a) Adverse Conditions—When a discharger is unable to collect samples within a specified sampling period due to adverse climatic conditions, the discharger shall collect a substitute sample from a separate qualifying event in the next period and submit the data along with data for the routine sample in that period. Adverse weather conditions that may prohibit the collection of samples include weather conditions that create dangerous conditions for personnel (such as local flooding, high winds, hurricane, tornadoes, electrical storms, etc.) or otherwise make the collection of a sample impracticable (e.g., drought, extended frozen conditions, etc.).

(b) Low Concentration Waiver—When the average concentration for a pollutant calculated from monitoring data collected from first 4 calendar years of monitoring is less than the corresponding reporting value for that pollutant (Monitoring Cut-Off Concentration), a facility may waive monitoring and reporting requirements in the last annual monitoring period. The facility must submit to the Division of Water Pollution Control, in lieu of the monitoring data, a certification that there has not been a significant change in industrial activity or the pollution prevention measures in area of the facility which drains to the outfall for which sampling was waived.

(c) When a discharger is unable to conduct annual chemical storm water sampling at an inactive and unstaffed site, the operator of the facility may exercise a waiver of the monitoring requirements as long as the facility remains inactive and unstaffed. The facility must submit to the Division of Water Pollution Control, in lieu of monitoring data, a certification statement on the TMSP Storm Water Monitoring Report stating that the site is inactive and unstaffed so that collecting a sample during a qualifying event is not possible.

(4) Representative Discharge. When a facility has two or more outfalls that, based on a consideration of industrial activity, significant materials, and management practices and activities within the area drained by the outfall, the permittee reasonably believes discharge substantially identical effluents, the permittee may test the effluent of one of such outfalls and report that the quantitative data also applies to the substantially identical outfall(s) provided that the permittee includes in the storm water pollution prevention plan a description of the location of the outfalls and explains in detail why the outfalls are expected to discharge substantially identical effluents. In addition, for each outfall that the permittee believes is representative, an estimate of the size of the drainage area (in square feet) and an estimate of the runoff coefficient of the drainage area [e.g., low (under 40 percent), medium (40 to 65 percent), or high (above 65 percent)] shall be provided in the plan. The permittee shall include the description of the location of the outfalls, explanation of why outfalls are expected to discharge substantially identical effluents, and estimate of the size of the drainage area and runoff coefficient with the TMSP Storm Water Monitoring Report.

(5) Alternative Certification. A discharger is not subject to the monitoring requirements of this section provided the discharger makes a certification for a given outfall or on a pollutant-by-pollutant basis in lieu of monitoring reports required under paragraph (b) below, under penalty of law, signed in accordance

with Part VII.G. (Signatory Requirements), that material handling equipment or activities, raw materials, intermediate products, final products, waste materials, by-products, industrial machinery or operations, or significant materials from past industrial activity, that are located in areas of the facility within the drainage area of the outfall are not presently exposed to storm water and are not expected to be exposed to storm water for the certification period. Such certification must be retained in the storm water pollution prevention plan, and submitted to the Division of Water Pollution Control in accordance with Part VI.B. of the fact sheet to this permit. In the case of certifying that a pollutant is not present, the permittee must submit the certification along with the monitoring reports required under paragraph (b) below. If the permittee cannot certify for an entire period, they must submit the date exposure was eliminated and any monitoring required up until that date. This certification option is not applicable to compliance monitoring requirements associated with effluent limitations.

d) Reporting.

Permittees with analytical monitoring requirements shall submit monitoring results for each outfall associated with industrial activity [or a certification in accordance with Sections (3), (4), or (5) above] obtained during the annual reporting period on TMSP Storm Water Monitoring Report Form(s) postmarked **no later than the March 31st of the following calendar year**. For each outfall, one signed TMSP Storm Water Monitoring Report form must be submitted to the Division of Water Pollution Control. Signed copies of TMSP Storm Water Monitoring Reports, or said certifications, shall be submitted to the following address:

Enforcement and Compliance Section
Tennessee Division of Water Pollution Control
6th Floor L & C Annex
401 Church Street
Nashville, TN 37243-1534

e) Quarterly Visual Examination of Storm Water Quality. Facilities shall perform and document a visual examination of a storm water discharge associated with industrial activity from each outfall, except discharges exempted below. The examination must be made at least once in each designated period [described in (1) below] during daylight hours unless there is insufficient rainfall or snow melt to produce a runoff event.

(1) Examinations shall be conducted in each of the following periods for the purposes of visually inspecting storm water quality associated with storm water runoff or snow melt: January through March; April through June; July through September; October through December.

(2) Examinations shall be made of samples collected within the first 30 minutes (or as soon thereafter as practical, but not to exceed 1 hour) of when the runoff or snowmelt begins discharging. The examinations shall document observations of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of storm water pollution. The examination must be conducted in a well lit area. No analytical tests are required to be performed on the samples. All such samples shall be collected from the discharge resulting from a storm event that is greater than 0.1 inches in magnitude and that occurs at least 72 hours from the previously measurable (greater than 0.1 inch rainfall) storm event. Where practicable, the same individual should carry out the collection and examination of discharges for the entire permit term.

(3) Visual examination reports must be maintained onsite in the pollution prevention plan or with other compliance records or with other compliance records. The report shall include the examination date and time, examination personnel, the nature of the discharge (i.e., runoff or snow melt), visual quality of the storm water discharge (including observations of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of storm water pollution), and probable sources of any observed storm water contamination.

(4) When a facility has two or more outfalls that, based on a consideration of industrial activity, significant materials, and management practices and activities within the area drained by the outfall, the permittee reasonably believes discharge substantially identical effluents, the permittee may collect a sample of effluent of one of such outfalls and report that the examination data also applies to the substantially identical outfall(s) provided that the permittee includes in the storm water pollution prevention plan a description of the location of the outfalls and explains in detail why the outfalls are expected to discharge substantially identical effluents. In addition, for each outfall that the permittee believes is representative, an estimate of the size of the drainage area (in square feet) and an estimate of the runoff coefficient of the drainage area [e.g., low (under 40 percent), medium (40 to 65 percent), or high (above 65 percent)] shall be provided in the plan.

(5) When a discharger is unable to conduct a visual examination as a result of adverse climatic conditions, the discharger must document the reason for not performing the visual examination and retain this documentation onsite with the records of the visual examination. Adverse weather conditions which may prohibit the collection of samples include weather conditions that create dangerous conditions for personnel (such as local flooding, high winds, hurricane, tornadoes, electrical storms, etc.) or otherwise make the collection of a sample impracticable (drought, extended frozen conditions, etc.).

(6) When a discharger is unable to conduct visual storm water examinations at an inactive and unstaffed site, the operator of the facility may exercise a waiver of the monitoring requirement as long as the facility remains inactive and unstaffed. The facility must maintain a certification with the pollution prevention plan stating that the site is inactive and unstaffed so that performing visual examinations during a qualifying event is not feasible.

6. Definitions

"Inactive Landfill" —For the purposes of this permit, a landfill is considered inactive when, on a permanent basis, it will no longer receive waste and has completed closure in accordance with any applicable Federal, State, and/or local requirements.

STATE OF TENNESSEE

NPDES PERMIT

Tracking No. TNR053487

General NPDES Permit for

STORM WATER DISCHARGES ASSOCIATED WITH INDUSTRIAL ACTIVITY

Effective February 1, 2002, through December 31, 2006

Tennessee Department of Environment and Conservation
Division of Water Pollution Control
401 Church Street
6th Floor, L&C Annex
Nashville, Tennessee 37243-1534

Under authority of the Tennessee Water Quality Control Act of 1977 (T.C.A. 69-3-101 et seq.) and the delegation of authority from the United States Environmental Protection Agency under the Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977 (33 U.S.C. 1251, et seq.):

Discharger: **Arnold Engineering Development Center**

is authorized to discharge: storm water associated with industrial activity

from a facility located: in **Arnold AFB, Franklin County**

to receiving waters named: **Unnamed Tributary of Brumalow Creek**

in accordance with effluent limitations, monitoring requirements and other conditions set forth herein.

Coverage under this general permit shall become effective on **November 15, 2001,** and shall expire on **December 31, 2006**.

Notice of Coverage Issuance date: **February 12, 2002**

Paul E. Davis, Director
Division of Water Pollution Control

Applicable Sector(s): **AA**
TMSP Requirements and Sectors are located at **http://www.state.tn.us/environment/permits/tmsp.htm**

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
Division of Water Pollution Control
Sixth Floor – L & C Annex
401 Church Street
Nashville, TN 37243-1534

MR. CHARLES KING
Vice Commander, AEDC

TMSP Tracking Number TNR053487

ARNOLD ENGINEERING DEVELOPMENT CENTER
1100 KINDEL DRIVE
ARNOLD AFB, TN 37389-1806

Tennessee Multi-Sector Permit (TMSP)
Notice of Coverage Fact Sheet

The Division of Water Pollution Control's recently received from your company a Notice of Intent (NOI) to be covered under the Tennessee Storm Water Multi-Sector General NPDES Permit for discharges of Storm Water associated with Industrial Activities (TMSP). The new TMSP became effective on February 1, 2002, and expires on December 31, 2006. We have recorded your facility's information and are hereby notifying you that your facility is covered under this general permit.

Enclosed with this fact sheet you will find a Notice of Coverage with the permit tracking number, facility's name, address, receiving stream information and the applicable industry-specific sector(s) that apply to your facility. You will notice that we have not provided a printed copy of the TMSP. Instead, we ask you to visit our web site, located at: www.state.tn.us/environment/permits/strmh2o.htm.

At our web site, ou will be able to download general and sector-specific requirements, as well as permit rationale, Notice of Determination, TMSP guidance documents, links to relevant web sites, and a copy of a No Exposure Certification form. If you don't have access to Internet, or have other questions, please contact us at 1-888-891-TDEC or by E-mail at *Storm.Water@state.tn.us*.

Thank you for your time and assistance.

Sincerely,
Permit Section
Division of Water Pollution Control

AA. Storm Water Discharges Associated With Industrial Activity From Fabricated Metal Products Industry

1. Discharges Covered Under This Section

The requirements listed under this section shall apply to storm water discharges associated with industrial activity from a facility engaged in manufacturing the following products and generally described by the SIC codes shown below:

SIC Code	Sector AA: Facilities That Manufacture Metal Products including Jewelry, Silverware and Plated Ware	Sampling Required?	Table Number
3411	Metal Cans	Yes	AA-1
3412	Metal Shipping Barrels, Drums, Kegs, and Pails	Yes	AA-1
3421	Cutlery	Yes	AA-1
3423	Hand and Edge Tools, Except Machine Tools and Handsaws	Yes	AA-1
3425	Saw Blades and Handsaws	Yes	AA-1
3429	Hardware, NEC	Yes	AA-1
3431	Enameled Iron and Metal Sanitary Ware	Yes	AA-1
3432	Plumbing Fixture Fittings and Trim	Yes	AA-1
3433	Heating Equipment, Except Electric and Warm Air Furnaces	Yes	AA-1
3441	Fabricated Structural Metal	Yes	AA-1
3442	Metal Doors, Sash, Frames, Molding, and Trim Manufacturing	Yes	AA-1
3443	Fabricated Plate Work (Boiler Shops)	Yes	AA-1
3444	Sheet Metal Work	Yes	AA-1
3446	Architectural and Ornamental Metal Work	Yes	AA-1
3448	Prefabricated Metal Buildings and Components	Yes	AA-1
3449	Miscellaneous Structural Metal Work	Yes	AA-1
3451	Screw Machine Products	Yes	AA-1
3452	Bolts, Nuts, Screws, Rivets, and Washers	Yes	AA-1
3462	Iron and Steel Forgings	Yes	AA-1
3463	Nonferrous Forgings	Yes	AA-1
3465	Automotive Stamping	Yes	AA-1
3469	Metal Stamping, NEC	Yes	AA-1
3471	Electroplating, Plating, Polishing, Anodizing, and Coloring	Yes	AA-1
3479	Coating, Engraving, and Allied Services, NEC	Yes	AA-1
3484	Small Arms	Yes	AA-1
3489	Ordnance and Accessories, NEC	Yes	AA-1
3491	Industrial Valves	Yes	AA-1
3494	Valves and Pipe Fittings, NEC	Yes	AA-1
3495	Wire Springs	Yes	AA-1
3496	Miscellaneous Fabricated Wire Products	Yes	AA-1
3498	Fabricated Pipe and Pipe Fittings	Yes	AA-1
3499	Fabricated Metal Products, NEC	Yes	AA-1
3911	Jewelry, Precious Metal	Yes	AA-1
3914	Silverware, Plated Ware, and Stainless Steel Ware	Yes	AA-1
3915	Jewelers' Findings and Materials, and Lapidary Work	Yes	AA-1

When an industrial facility, described by the above coverage provisions of this section, has industrial activities being conducted onsite that meet the description(s) of industrial activities in another section(s), that industrial facility shall comply with any and all applicable monitoring and pollution prevention plan requirements of the other section(s) in addition to all applicable requirements in this section. The monitoring and pollution prevention plan terms and conditions of this multi-sector permit are additive for industrial activities being conducted at the same industrial facility (co-located industrial activities). The operator of the facility shall determine which other monitoring and pollution prevention plan section(s) of this permit (if any) are applicable to the facility.

2. Special Conditions

Prohibition of Non-storm Water Discharges

This permit does not authorize the discharge of process wastewater. Certain non-storm discharges identified in Part III.A.2. are authorized under this permit.

3. Storm Water Pollution Prevention Plan Requirements

Contents of Plan. The plan shall include, at a minimum, the following items:

Pollution Prevention Team. Each plan shall identify a specific individual or individuals within the facility organization as members of a storm water Pollution Prevention Team that are responsible for developing the storm water pollution prevention plan and assisting the facility or plant manager in its implementation, maintenance, and revision. The plan shall clearly identify the responsibilities of each team member. The activities and responsibilities of the team shall address all aspects of the facility's storm water pollution prevention plan.

Description of Potential Pollutant Sources. Each plan shall provide a description of potential sources which may reasonably be expected to add significant amounts of pollutants to storm water discharges or which may result in the discharge of pollutants during dry weather from separate storm sewers draining the facility. Each plan shall identify all industrial activities and significant materials which may potentially be significant pollutant sources. Each plan shall specifically identify the physical features of the facility that may contribute to storm water runoff. Each plan shall include, at a minimum:

Drainage. A site map indicating the outfall locations and types of discharges contained in the drainage areas of the outfalls, an outline of the portions of the drainage area of each storm water outfall that are within the facility boundaries, each existing structural control measure to reduce pollutants in storm water runoff, surface water bodies, locations where significant materials are exposed to precipitation, locations where major spills or leaks identified under Part IX.AA.3.a.(2)(c) (Spills and Leaks) of this permit have occurred, and the locations of the following activities where such activities are exposed to precipitation: raw metal storage areas, finished metal storage areas, scrap disposal collection sites, equipment storage areas, retention and detention basins, temporary diversion dikes or berms, permanent diversion dikes or berms, right-of-way or perimeter diversion devices, any sediment traps or barriers, vehicle and equipment maintenance and/or cleaning areas, loading/unloading areas, locations used for the treatment, storage or disposal of wastes, liquid storage tanks, processing areas including outside painting areas, wood preparation, recycling and raw material storage.

For each area of the facilities that generates storm water discharges associated with industrial activity with a reasonable potential for containing significant amounts of pollutants, a prediction of the direction of flow, and an identification of the types of pollutants which are likely to be present in storm water discharges associated with industrial activity. Factors to consider include the toxicity of chemical; quantity of chemicals used, produced or discharged; the likelihood of contact with storm water; and history of significant leaks or spills of toxic or hazardous pollutants. In addition, flows with a significant potential for causing erosion shall be identified such as heavy equipment use areas, drainage from roofs, parking lots, etc.

Inventory of Exposed Materials—An inventory of the types of materials handled at the site that potentially may be exposed to precipitation. Such inventory shall include a narrative description of significant materials that have been handled, treated, stored or disposed in a manner to allow exposure to storm water between the time of 3 years prior to the date of the submission of a Notice of Intent (NOI) to be covered under this permit and the present; method and location of onsite storage or disposal; materials management practices employed to minimize contact of materials with storm water runoff between the time of 3 years prior to the date of the submission of a Notice of Intent (NOI) to be covered under this permit and the present; the location and a description of existing structural and nonstructural control measures to reduce pollutants in storm water runoff; and a description of any treatment the storm water receives.

Spills and Leaks—A list of significant spills and significant leaks of toxic or hazardous pollutants that occurred at areas that are exposed to precipitation or that otherwise drain to a storm water conveyance at the facility after the date of 3 years prior to the date of the submission of a Notice of Intent (NOI) to be covered under this permit. Significant spills that should be considered for the fabricated metals industry include, but are not limited to, chromium, toluene, pickle liquor, sulfuric acid, zinc and other water priority chemicals and hazardous chemicals and wastes. Such list shall be updated as appropriate during the term of the permit.

Sampling Data—A summary of existing discharge sampling data describing pollutants in storm water discharges from the facility, including a summary of sampling data collected during the term of this permit.

Risk Identification and Summary of Potential Pollutant Sources—A narrative description of the potential pollutant sources from the following activities: loading and unloading operations for paints, chemicals and raw materials; outdoor storage activities for raw materials, paints, empty containers, corn cob, chemicals, scrap metals; outdoor manufacturing or processing activities such as grinding, cutting, degreasing, buffing, brazing, etc.; significant dust or particulate generating processes; and onsite waste disposal practices for spent solvents, sludge, pickling baths, shavings, ingots pieces, refuse and waste piles. The description shall specifically list any significant potential source of pollutants at the site and for each potential source, any pollutant or pollutant parameter (e.g., biochemical or chemical oxygen demand, chromium, total suspended solids, oil and grease, etc.) of concern shall be identified.

Measures and Controls. Each facility covered by this permit shall develop a description of storm water management controls appropriate for the facility, and implement such controls. The appropriateness and priorities of controls in a plan shall reflect identified potential sources of pollutants at the facility. The description of storm water management controls shall address the following minimum components, including a schedule for implementing such controls:

Good Housekeeping—Good housekeeping requires the maintenance of areas which may contribute pollutants to storm water discharges in a clean, orderly manner. Permittees should address the following areas in the manner described.

Raw Steel Handling Storage-Include measures controlling or recovering scrap metals, fines, and iron dust, including measures for containing materials within storage handling areas.

Paints and Painting Equipment-Consider control measures to prevent or minimize exposure of paint and painting equipment from exposure to storm water.

Preventive Maintenance—Preventive maintenance measures shall include timely inspection and maintenance of storm water management devices (e.g., cleaning oil/water separators, catch basins) as well as inspecting and testing facility equipment and systems to uncover conditions that could cause breakdowns or failures resulting in discharges of pollutants to surface waters, and ensuring appropriate maintenance of such equipment and systems.

Spill Prevention and Response Procedures—Areas where potential spills which could contribute pollutants to storm water discharges may occur, and their accompanying drainage points shall be identified clearly in the storm water pollution prevention plan. Where appropriate, specifying material handling procedures, storage requirements, and use of equipment such as diversion valves in the plan should be considered. Procedures for cleaning up spills shall be identified in the plan and made available to the appropriate personnel. The necessary equipment to implement a clean up should be available to personnel. The following areas should be addressed:

Metal Fabricating Areas-Include measures for maintaining clean, dry, orderly conditions in these areas. Use of dry clean-up techniques should be considered in the plan.

Storage Areas for Raw Metal-Include measures to keep these areas free of conditions that could cause spills or leakage of materials. Storage areas should be maintained for easy access in case spill clean up is necessary. Stored materials should be able to be identified correctly and quickly.

Receiving, Unloading, and Storage Areas-Include measures to prevent spills and leaks; plan for quick remedial clean up and instruct employees on clean-up techniques and procedures.

Storage of Equipment-Include measures for preparing equipment for storage and the proper method to store equipment including protecting with covers, storing indoors. The plan should include clean-up measures for equipment that will be stored outdoors to remove potential pollutants.

Metal Working Fluid Storage Areas-The plan should include measures that identify controls particularly for storage of metal working fluids.

Cleaners and Rinse Water-The plan should include measures to control and cleanup spills of solvents and other liquid cleaners; control sand buildup and disbursement from sand-blasting operations, prevent exposure of recyclable wastes; and employ substitute cleaners when possible.

Lubricating Oil and Hydraulic Fluid Operations-Consider using devices or monitoring equipment to detect and control leaks and overflows, including the installation of perimeter controls such as dikes, curbs, grass filter strips, or other equivalent measures.

Chemical Storage Areas-Identify proper storage that prevents storm water contamination and prevents accidental spillage. The plan should include a program to inspect containers, and identify proper disposal and spill controls.

Inspections—Qualified facility personnel shall be identified to inspect designated equipment and areas of the facility at appropriate intervals specified in the plan. Metal fabricators shall at a minimum include the following areas for inspection: raw metal storage areas, finished product storage areas, material and chemical storage areas, recycling areas, loading and unloading areas, equipment storage areas, paint areas, fueling and maintenance areas, and waste management areas. A set of tracking or follow-up procedures shall be used to ensure that appropriate actions are taken in response to the inspections. Records of inspections shall be maintained.

Employee Training—Employee training programs shall inform personnel responsible for implementing activities identified in the storm water pollution prevention plan or otherwise responsible for storm water management at all levels of responsibility of the components and goals of the storm water pollution prevention plan. Training should address topics such as spill response, good housekeeping, and material management practices. The pollution prevention plan shall identify periodic dates for such training.

Recordkeeping and Internal Reporting Procedures—A description of incidents (such as spills, or other discharges), along with other information describing the quality and quantity of storm water discharges shall be included in the plan required under this part. Inspections and maintenance activities shall be documented and records of such activities shall be incorporated into the plan.

Non-storm Water Discharges

The plan shall include a certification that the discharge has been tested or evaluated for the presence of non-storm water discharges. The certification shall include the identification of potential significant sources of non-storm water at the site, a description of the results of any test and/or evaluation for the presence of non-storm water discharges, the evaluation criteria or testing method used, the date of any testing and/or evaluation, and the onsite drainage points that were directly observed during the test. Certifications shall be signed in accordance with Part VII.G. of this permit. Such certification may not be feasible if the facility operating the storm water discharge associated with industrial activity does not have access to an outfall, manhole, or other point of access to the ultimate conduit which receives the discharge. In such cases, the source identification section of the storm water pollution prevention plan shall indicate why the certification required by this part was not feasible, along with the identification of potential significant sources of non-storm water at the site. A discharger that is unable to provide the certification required by this paragraph must notify the Division of Water Pollution Control in accordance with paragraph XI.AA.3.a.(3)(g)(iii) (below).

Sources of non-storm water that are combined with storm water discharges associated with industrial activity must be identified in the plan. The plan shall identify and ensure the implementation of appropriate pollution prevention measures for the non-storm water component(s) of the discharge. Any non-storm water discharges that are not permitted under an individual NPDES permit should be brought to the attention of the Division's local Environmental Assistance Center (see list of EACs on page 11).

Failure to Certify—Any facility that is unable to provide the certification required (testing for non-storm water discharges), must notify the Division of Water Pollution Control by not later than 180 days after submitting a notice of intent to be covered by this permit. If the failure to certify is caused by the inability to perform adequate tests or evaluations, such notification shall describe: the procedure of any test conducted for the presence of non-storm water discharges; the results of such test or other relevant observations; potential sources of non-storm water discharges to the storm sewer; and why adequate tests for such storm sewers were not feasible. Non-storm water discharges to waters of the State which are not authorized by an NPDES permit are unlawful, and must be terminated.

Sediment and Erosion Control—The plan shall identify areas which, due to topography, activities, or other factors, have a high potential for significant soil erosion. The plan shall identify structural, vegetative, and/or stabilization measures to be used to limit erosion. These shall include but not be limited to grass swales, filter strips, treatment works, or other equivalent measures. Metal fabricators must include in their plan measures to minimize erosion related to the high volume of traffic from heavy equipment for delivery to and from the facility and for equipment operating at the facility on a daily basis such as forklifts, cranes, etc.

Management of Runoff—The plan shall contain a narrative consideration of the appropriateness of traditional storm water management practices (practices other than those which control the generation or source(s) of pollutant(s) used to divert, infiltrate, reuse, or otherwise manage storm water runoff in a manner that reduces pollutants in storm water discharges from the site. The plan shall provide that measures that the permittee determines to be reasonable and appropriate shall be implemented and maintained. The potential of various sources at the facility to contribute pollutants to storm water discharges associated with industrial activities under the SIC codes identified under paragraph XI.AA.1. of this section shall be considered when determining reasonable and appropriate measures. Appropriate measures may include: vegetative swales and practices, reuse of collected storm water (such as for a process or as an irrigation source), inlet controls (such as oil/water separators), snow management activities, infiltration devices, and wet detention/retention devices.

Comprehensive Site Compliance Evaluation. Qualified personnel shall conduct site compliance evaluations at least once a year. Such evaluations shall include:

Visual inspection of areas contributing to a storm water discharge for evidence of, or the potential for, pollutants entering the drainage system. Inspection shall address areas associated with the storage of raw metals, storage of spent solvents and chemicals, outdoor paint areas, drainage from roof, unloading and loading areas, equipment storage areas, recycling areas, and retention ponds (sludge). Potential pollutants include chromium, zinc, lubricating oil, solvents, aluminum, oil and grease, methyl ethyl ketone, steel, and other related materials. Measures to reduce pollutant loadings shall be evaluated to determine whether they are adequate and properly implemented in accordance with the terms of the permit or whether additional control measures are needed. Structural storm water management measures, such as detention basins and channels, gutters or drains to direct discharge flow, oil/water separators in storm drains, containment structures, concrete pads, sediment and erosion control measures, and other structural pollution prevention measures identified in the plan shall be observed to ensure that they are operating correctly. A visual inspection of equipment needed to implement the plan, such as spill response equipment and containment drums, shall be made to determine if the equipment is functioning properly and that drums are not in a corrosive or deteriorating state.

Based on the results of the evaluation, the description of potential pollutant sources identified in the plan in accordance with paragraph XI.AA.3.a.(2) of this section (Description of Potential Pollutant Sources) and pollution prevention measures and controls identified in the plan in accordance with paragraph XI.AA.3.a.(3) of this section (Measures and Controls) shall be revised as appropriate within 2 weeks of such evaluation and shall provide for implementation of any changes to the plan in a timely manner, but in no case more than 12 weeks after the evaluation.

A report summarizing the scope of the evaluation, personnel making the evaluation, the date(s) of the evaluation, major observations relating to the implementation of the storm water pollution prevention plan, and actions taken in accordance with paragraph XI.AA.3.a.(4)(b) (above) of the permit shall be made and retained as part of the storm water pollution prevention plan for at least 3 years from the date of the inspection. The report shall identify any incidents of noncompliance. Where a report does not identify any incidents of noncompliance, the report shall contain a certification that the facility is in compliance with the storm water pollution prevention plan and this permit. The report shall be signed in accordance with Part VII.G. (Signatory Requirements) of this permit.

Where compliance evaluation schedules overlap with inspections required under 3.a.(3)(d), the compliance evaluation may be conducted in place of one such inspection.

4. Numeric Effluent Limitations

There are no additional numeric effluent limitations beyond those described in Part V.B. of this permit.

5. Monitoring and Reporting Requirements

a) Analytical Monitoring Requirements.

During the term of this permit, permittees covered under this sector must monitor their storm water discharges associated with industrial activity at least **once per calendar year (annually),** except as provided in paragraphs 5.a.(3) (Sampling Waiver), 5.a.(4) (Representative Discharge), and 5.a.(5) (Alternative Certification). For SIC-specific breakdown of monitoring requirements and applicable Monitoring Requirements (listed below), see Table in Part 1 of this industrial sector (1. Discharges Covered Under This Section). Facilities must report in accordance with 5.b. (Reporting). In addition to the parameters listed in Tables AA-1 and AA-2 below, the permittee shall maintain a record of the date and duration (in hours) of the storm event(s) sampled; rainfall measurements or estimates (in inches) of the storm event that generated the sampled runoff; the duration between the storm event sampled and the end of the previous measurable (greater than 0.1 inch rainfall) storm event; and an estimate of the total volume (in gallons) of the discharge sampled.

Table AA-1.
Monitoring Requirements for Fabricated Metal Products Except Coating

Pollutants of Concern	Monitoring Cut-Off Concentration	Sector Median Value * [mg/L]
Total Recoverable Aluminum	0.75 mg/L	0.60
Total Recoverable Iron	5.0 mg/L	0.67
Total Recoverable Zinc	0.395 mg/L	0.16
Nitrate plus Nitrite Nitrogen	0.68 mg/L	0.53

Table AA-2.
Monitoring Requirements for Fabricated Metal Coating and Engraving

Pollutants of Concern	Monitoring Cut-Off Concentration	Sector Median Value * [mg/L]
Total Recoverable Zinc	0.395 mg/L	0.16
Nitrate plus Nitrite Nitrogen	0.68 mg/L	0.53

* Sector Median Value is a pollutant concentration calculated from all sampling results provided from facilities classified in this sector during the previous permit term. By definition, a median is a statistical term identifying a number that divides numerically ordered data into two equal halves. In easier terms, the median is the middle piece of data when those data are placed in numerical order, or the average of the middle two if there is an even number of items. Therefore, median concentration(s) listed above represent a concentration value typical for and achieved by industries in this sector.

(1) Monitoring Periods. Metal fabricating facilities shall monitor samples collected during any period of a calendar year, as long as the samples are representative of the quantity and quality of the storm water runoff being discharged from the facility.

(2) Sample Type. A minimum of one grab sample shall be taken. All such samples shall be collected from the discharge resulting from a storm event that is greater than 0.1 inches in magnitude and that occurs at least 72 hours from the previously measurable (greater than 0.1 inch rainfall) storm event. The required 72-hour storm event interval is waived where the preceding measurable storm event did not result in a measurable discharge from the facility. The required 72-hour storm event interval may also be waived where the permittee documents that less than a 72-hour interval is representative for local storm events during the season when sampling is being conducted. The grab sample shall be taken during the first 30 minutes of the discharge. If the collection of a grab sample during the first 30 minutes is impracticable, a grab sample can be taken during the first hour of the discharge, and the discharger shall submit with the monitoring report a description of why a grab sample during the first 30 minutes was impracticable. If storm water discharges associated with industrial activity commingle with process or nonprocess water, then where practicable permittees must attempt to sample the storm water discharge before it mixes with the non-storm water discharge.

In addition, the permittee shall evaluate the results obtained from sampling and monitoring following the required annual sampling events to determine whether the facility is below, meets, or exceeds the monitoring cut-off concentrations as shown in the Table above. If the results of annual storm water runoff monitoring demonstrate that the facility has exceeded the cut-off concentration(s), the permittee must inform the Division's local Environmental Assistance Center in writing within 30 days from the time SW monitoring results were received, describing the likely cause of the exceedance(s). Furthermore, within 60 days from the time SW monitoring results were received, the facility must review its storm water pollution prevention plan, make any modifications or additions to the plan which would assist in reducing effluent concentrations to less than the monitoring cut-off concentrations for that facility, and submit to the Division's local Environmental Assistance Center a brief summary of the proposed SWPPP modifications (including a timetable for implementation).

(3) Sampling Waiver

(a) Adverse Conditions—When a discharger is unable to collect samples within a specified sampling period due to adverse climatic conditions, the discharger shall collect a substitute sample from a separate qualifying event in the next period and submit the data along with data for the routine sample in that period. Adverse weather conditions that may prohibit the collection of samples include weather conditions that create dangerous conditions for personnel (such as local flooding, high winds, hurricane, tornadoes, electrical storms, etc.) or otherwise make the collection of a sample impracticable (drought, extended frozen conditions, etc.).

(b) Low Concentration Waiver—When the average concentration for a pollutant calculated from monitoring data collected from first 4 calendar years of monitoring is less than the corresponding reporting value for that pollutant (Monitoring Cut-Off Concentration), a facility may waive monitoring and reporting requirements in the last annual monitoring period. The facility must submit to the Division of Water Pollution Control, in lieu of the monitoring data, a certification that there has not been a significant change in industrial activity or the pollution prevention measures in areas of the facility which drains to the outfall for which sampling was waived.

(c) When a discharger is unable to conduct annual chemical storm water sampling at an inactive and unstaffed site, the operator of the facility may exercise a waiver of the monitoring requirements as long as the facility remains inactive and unstaffed. The facility must submit to the Division of Water Pollution Control, in lieu of monitoring data, a certification statement on the TMSP Storm Water Monitoring Report stating that the site is inactive and unstaffed so that collecting a sample during a qualifying event is not possible.

(4) Representative Discharge. When a facility has two or more outfalls that, based on a consideration of industrial activity, significant materials, and management practices and activities within the area drained by the outfall, the permittee reasonably believes discharge substantially identical effluents, the permittee may test the effluent of one of such outfalls and report that the quantitative data also applies to the substantially identical outfall(s) provided that the permittee includes in the storm water pollution prevention plan a description of the location of the outfalls and explains in detail why the outfalls are expected to discharge substantially identical effluents. In addition, for each outfall that the permittee believes is representative, an estimate of the size of the drainage area (in square feet) and an estimate of the runoff coefficient of the drainage area [e.g., low (under 40 percent), medium (40 to 65 percent), or high (above 65 percent)] shall be provided in the plan. The permittee shall include the description of the location of the outfalls, explanation of why outfalls are expected to discharge substantially identical effluents, and estimate of the size of the drainage area and runoff coefficient with the TMSP Storm Water Monitoring Report.

(5) Alternative Certification. A discharger is not subject to the monitoring requirements of this section provided the discharger makes a certification for a given outfall or on a pollutant-by-pollutant basis in lieu of monitoring reports required under paragraph b below, under penalty of law, signed in accordance with Part VII.G. (Signatory Requirements), that material handling equipment or activities, raw materials, intermediate products, final products, waste materials, by-products, industrial machinery or operations, or significant materials from past industrial activity that are located in areas of the facility within the drainage area of the outfall are not presently exposed to storm water and are not expected to be exposed to storm water for the certification period. Such certification must be retained in the storm water pollution prevention plan, and submitted to the Division of Water Pollution Control in accordance with Part VI.B.

of this permit. In the case of certifying that a pollutant is not present, the permittee must submit the certification along with the monitoring reports required under paragraph (b) below. If the permittee cannot certify for an entire period, they must submit the date exposure was eliminated and any monitoring required up until that date. This certification option is not applicable to compliance monitoring requirements associated with effluent limitations.

b) Reporting.

Permittees with analytical monitoring requirements shall submit monitoring results for each outfall associated with industrial activity [or a certification in accordance with Sections (3), (4), or (5) above] obtained during the annual reporting period on TMSP Storm Water Monitoring Report Form(s) postmarked **no later than the March 31st of the following calendar year**. For each outfall, one signed TMSP Storm Water Monitoring Report form must be submitted to the Division of Water Pollution Control. Signed copies of TMSP Storm Water Monitoring Reports, or said certifications, shall be submitted to the following address:

Enforcement and Compliance Section
Tennessee Division of Water Pollution Control
6th Floor L & C Annex
401 Church Street
Nashville, TN 37243-1534

c) Quarterly Visual Examination of Storm Water Quality. Facilities shall perform and document a visual examination of a storm water discharge associated with industrial activity from each outfall, except discharges exempted below. The examination must be made at least once in each designated period [described in paragraph (1) below] during daylight hours unless there is insufficient rainfall or snow melt to produce a runoff event.

(1) Examinations shall be conducted in each of the following periods for the purposes of visually inspecting storm water quality associated with storm water runoff or snowmelt: January through March; April through June; July through September; and October through December.

(2) Examinations shall be made of samples collected within the first 30 minutes (or as soon thereafter as practical, but not to exceed 1 hour) of when the runoff or snowmelt begins discharging. The examinations shall document observations of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of storm water pollution. The examination must be conducted in a well lit area. No analytical tests are required to be performed on the samples. All such samples shall be collected from the discharge resulting from a storm event that is greater than 0.1 inches in magnitude and that occurs at least 72 hours from the previously measurable (greater than 0.1 inch rainfall) storm event. Where practicable, the same individual should carry out the collection and examination of discharges for the entire permit term.

(3) Visual examination reports must be maintained onsite in the pollution prevention plan or with other compliance records. The report shall include the examination date and time, examination personnel, the nature of the discharge (i.e., runoff or snow melt), visual quality of the storm water discharge (including observations of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of storm water pollution), and probable sources of any observed storm water contamination.

(4) When a facility has two or more outfalls that, based on a consideration of industrial activity, significant materials, and management practices and activities within the area drained by the outfall, the permittee reasonably believes discharge substantially identical effluents, the permittee may collect a sample of effluent of one of such outfalls and report that the examination data also applies to the substantially identical outfall(s) provided that the permittee includes in the storm water pollution prevention plan a description of the location of the outfalls and explains in detail why the outfalls are expected to discharge substantially identical effluents. In addition, for each outfall that the permittee believes is representative, an estimate of the size of the drainage area (in square feet) and an estimate of the runoff coefficient of the drainage area [e.g., low (under 40 percent), medium (40 to 65 percent), or high (above 65 percent)] shall be provided in the plan.

(5) When a discharger is unable to collect samples over the course of the visual examination period as a result of adverse climatic conditions, the discharger must document the reason for not performing the visual examination and retain this documentation onsite with the records of the visual examinations. Adverse weather conditions which may prohibit the collection of samples include weather conditions that create dangerous conditions for personnel (such as local flooding, high winds, hurricane, tornadoes, electrical storms, etc.) or otherwise make the collection of a sample impracticable (drought, extended frozen conditions, etc.).

(6) When a discharger is unable to conduct visual storm water examinations at an inactive and unstaffed site, the operator of the facility may exercise a waiver of the monitoring requirement as long as the facility remains inactive and unstaffed. The facility must maintain a certification with the pollution prevention plan stating that the site is inactive and unstaffed so that performing visual examinations during a qualifying event is not feasible.

APPENDIX D

NPDES Monitoring Results
CY 2000 - 2005

Table E-1: Monitoring Results CY 2000 - 2005

Outfall 001												
Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2000			2001		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow	Report MGD		Report MGD		Continuous	Recorder	2.223	174.699	12.30 - 86.73	0.049	122.57	7.05 - 41.81
pH	6.5 to 9.0				Continuous	Recorder	6.46	8.9	7.58 - 8.53	6.97	9.21	7.68 - 8.45
CBOD	15	NA	25	NA	1/week	Composite	1.345	5.785	2.05 - 4.69	0.26	7.02	1.69 - 5.38
Nitrogen, Ammonia Total	1.1	NA	2.2	NA	1/week	Composite	ND	0.39	ND - 0.216	ND	0.19	ND - 0.1
Dissolved Oxygen	6.0 mg/L minimum				1/week	Grab	6.8	12.2	6.95 - 10.35	6	14.7	6.275 - 12
TSS (Influent)	Report	NA	Report	NA	1/month	Composite	4	17.5	4 - 17.5	ND	11	ND - 11
TDS (Influent)	Report	NA	Report	NA	1/month	Composite	100.2	123.3	100.2 - 123.3	94.1	118.2	94.1 - 115.8
TSS (Effluent)	Report	NA	Report	NA	1/month	Composite	4.4	23	4.4 - 23	ND	18.9	5.8 - 18.9
TDS (Effluent)	Report	NA	Report	NA	1/month	Composite	103.1	139.7	103.1 - 139.7	101.1	126.1	101.1 - 126.1
Oil & Grease	10	NA	15	NA	1/month	Grab	ND	ND	ND	ND	ND	ND
Copper, Total	0.03	NA	0.04	NA	1/month	Composite	ND	0.0124	ND - 0.00495	ND	0.0118	ND - 0.0086
Cadmium, Total	0.003	NA	0.005	NA	1/week	Composite	ND	0.0027	ND - 0.00054	ND	0.0023	ND - 0.00046
Chromium, Total	0.1	NA	0.2	NA	1/month	Composite	ND	0.0102	ND - 0.00204	ND	ND	ND
Lead, Total	0.01	NA	0.1	NA	1/week	Composite	ND	0.005	ND - 0.0025	ND	0.012	ND - 0.0045
Selenium Total	0.0005	NA	0.01	NA	1/week	Composite						
Silver, Total	NA	NA	0.003	NA	1/month	Composite	ND	ND	ND	ND	ND	ND
Chlorine, Total Residual	0.011	NA	0.019	NA	1/week	Grab	ND	ND	ND	ND	ND	ND
Temperature, Effluent	Report (Degrees C)				Continuous	Recorder	1.62	32.08	7.21 - 29.45	1.28	31.38	5.77 - 29.43
IC25	Survival, Reproduction, & Growth in 100% Effulent				Semi-annual	Composite						

Table E-1: (continued)

Outfall 001

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2002			2003		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow	Report MGD		Report MGD		Continuous	Recorder	0.004	200.622	1.41 - 98.79	0.336	106.249	1.19 - 39.83
pH	6.5 to 9.0				Continuous	Recorder	6.9	9.05	7.46 - 8.78	6.74	9.02	7.34 - 8.62
CBOD	15	NA	25	NA	1/week	Composite	0.13	6.15	1.9 - 4.51	1.1	5.365	1.85 - 3.78
Nitrogen, Ammonia Total	1.1	NA	2.2	NA	1/week	Composite	ND	0.25	ND - 0.12	ND	0.26	ND - 0.1475
Dissolved Oxygen	6.0 mg/L minimum				1/week	Grab	6	11.4	6.35 - 10.16	6.1	11.3	6.4 - 10.34
TSS (Influent)	Report	NA	Report	NA	1/month	Composite	ND	8	ND - 8	ND	8	ND - 8
TDS (Influent)	Report	NA	Report	NA	1/month	Composite	90.4	115.6	90.4 - 115.6	86	137	86 - 137
TSS (Effluent)	Report	NA	Report	NA	1/month	Composite	ND	21.4	ND - 21.4	ND	17.7	ND - 17.7
TDS (Effluent)	Report	NA	Report	NA	1/month	Composite	89	122	89 - 122	79.6	135	79.6 - 135
Oil & Grease	10	NA	15	NA	1/month	Grab	ND	ND	ND	ND	ND	ND
Copper, Total	0.03	NA	0.04	NA	1/month	Composite	ND	0.015	ND - 0.00828	ND	0.012	ND - 0.007
Cadmium, Total	0.003	NA	0.005	NA	1/week	Composite	ND	0.001	ND - 0.00025	ND	ND	ND
Chromium, Total	0.1	NA	0.2	NA	1/month	Composite	ND	0.001	ND - 0.0006	ND	0.009	ND - 0.00225
Lead, Total	0.01	NA	0.1	NA	1/week	Composite	ND	0.009	ND - 0.0028	ND	0.007	ND - 0.0022
Selenium Total	0.0005	NA	0.01	NA	1/week	Composite						
Silver, Total	NA	NA	0.003	NA	1/month	Composite	ND	ND	ND	ND	ND	ND
Chlorine, Total Residual	0.011	NA	0.019	NA	1/week	Grab	ND	ND	ND	ND	ND	ND
Temperature, Effluent	Report (Degrees C)				Continuous	Recorder	3.27	31.5	7.18 - 29.36	2.62	31.11	6.65 - 29.15
IC25	Survival, Reproduction, & Growth in 100% Effulent				Semi-annual	Composite						

Table E-1: (continued)

Outfall 001												
Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2004			2005		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow	Report MGD		Report MGD		Continuous	Recorder	0.012	114.535	7.01 - 61.19	0.137	123.927	4.52 - 59.59
pH	6.5 to 9.0				Continuous	Recorder	7.17	9.04	7.83 - 8.50	7.17	9.04	7.77 - 8.67
CBOD	15	NA	25	NA	1/week	Composite	0.065	6.905	1.04 - 4.64	0.615	5.41	2.12 - 4.066
Nitrogen, Ammonia Total	1.1	NA	2.2	NA	1/week	Composite	ND	0.21	ND - 0.1225	ND	0.24	ND - 0.17
Dissolved Oxygen	6.0 mg/L minimum				1/week	Grab	6.5	13.1	7.32 - 12.07	6.5	12.8	6.92 - 12.52
TSS (Influent)	Report	NA	Report	NA	1/month	Composite	ND	6.8	ND - 6.8	ND	6.7	ND - 6.7
TDS (Influent)	Report	NA	Report	NA	1/month	Composite	104	181	104 - 181	90	187	90 - 187
TSS (Effluent)	Report	NA	Report	NA	1/month	Composite	4.3	26.5	4.3 - 26.5	6.1	20.8	6.1 - 20.8
TDS (Effluent)	Report	NA	Report	NA	1/month	Composite	115	178.2	115 - 178.2	148	196	148 - 196
Oil & Grease	10	NA	15	NA	1/month	Grab	ND	ND	ND	ND	ND	ND
Copper, Total	0.03	NA	0.04	NA	1/month	Composite	ND	0.0118	ND - 0.0118	ND	0.0141	ND - 0.0141
Cadmium, Total	0.003	NA	0.005	NA	1/week	Composite	ND	ND	ND	ND	0.00066	ND - 0.000214
Chromium, Total	0.1	NA	0.2	NA	1/month	Composite	ND	0.00542	ND - 0.00542	ND	0.00041	ND - 0.00041
Lead, Total	0.01	NA	0.1	NA	1/week	Composite	ND	0.00459	ND - 0.00135	ND	0.00493	ND - 0.00211
Selenium Total	0.0005	NA	0.01	NA	1/week	Composite						
Silver, Total	NA	NA	0.003	NA	1/month	Composite	ND	ND	ND	ND	ND	ND
Chlorine, Total Residual	0.011	NA	0.019	NA	1/week	Grab	ND	ND	ND	ND	ND	ND
Temperature, Effluent	Report (Degrees C)				Continuous	Recorder	4.86	30.52	7.22 - 27.86	5.74	30.52	7.64 - 28.89
IC25	Survival, Reproduction, & Growth in 100% Effulent				Semi-annual	Composite						

Table E-1: (continued)

Outfall 004

Effluent Characteristic	Monthly Average Concentration (mg/L)	Average Amount (lb/day)	Daily Maximum Concentration (mg/L)	Maximum Amount (lb/day)	Monitoring Requirements: Frequency	Monitoring Requirements: Sample Type	2000: Minimum Reported Value	2000: Maximum Reported Value	2000: Range of Average Reported Values	2001: Minimum Reported Value	2001: Maximum Reported Value	2001: Range of Average Reported Values
Flow	Report MGD		Report MGD		5/week	Instantaneous	20529	85845	28558.90 - 47590.33	8165	86318	14128.09 - 44230.39
pH	6.0 to 9.0				5/week	Grab	6.7	7.7	7.10 - 7.48	6.7	7.8	7.04 - 7.47
BOD	30	NA	45	NA	2/month	Composite	1.289	10.42	1.56 - 7.57	1.13	19.91	2.02 - 13.32
Nitrogen, Ammonia Total	5	NA	8	NA	2/month	Composite	ND	1.22	ND - 0.74	ND	2.65	0.1 - 1.55
Fecal Coliform	30	NA	45	NA	2/month	Composite	ND	196	2 - 125	ND	116	2 - 95
TSS	200/100 mL	NA	400/100 mL	NA	2/month	Grab						
E. Coli	NA	NA	126/100 mL	NA	3/week	Grab	ND	ND	ND	ND	ND	ND
Dissolved Oxygen	1.0 mg/L minimum				5/week	Grab	4	9.1	6.65 - 8.42	5	9.6	6.1 - 8.4
Chlorine, Total Residual			0.5	NA	2/week	Grab	0.15	0.48	0.26 - 0.37	0.032	0.46	0.281 - 0.38
Solids, Settleable	NA	NA	1.0 mL/L	NA	2/week	Grab						

Outfall 004

Effluent Characteristic	Monthly Average Concentration (mg/L)	Average Amount (lb/day)	Daily Maximum Concentration (mg/L)	Maximum Amount (lb/day)	Monitoring Requirements: Frequency	Monitoring Requirements: Sample Type	2002: Minimum Reported Value	2002: Maximum Reported Value	2002: Range of Average Reported Values	2003: Minimum Reported Value	2003: Maximum Reported Value	2003: Range of Average Reported Values
Flow	Report MGD		Report MGD		5/week	Instantaneous	6326	56920	14138.74 - 20598.25	188	86141	12247.96 - 21300.16
pH	6.0 to 9.0				5/week	Grab	6.3	7.4	6.74 - 7.26	6.4	8.3	6.84 - 7.2
BOD	30	NA	45	NA	2/month	Composite	1.89	7.96	1.97 - 7.81	1.59	9.14	1.86 - 5.43
Nitrogen, Ammonia Total	5	NA	8	NA	2/month	Composite	ND	1.74	0.03 - 0.97	ND	1.82	ND - 1.055
Fecal Coliform	30	NA	45	NA	2/month	Composite	ND	400	ND - 170	ND	35	1 - 21.5
TSS	200/100 mL	NA	400/100 mL	NA	2/month	Grab						
E. Coli	NA	NA	126/100 mL	NA	3/week	Grab	ND	ND	ND	ND	12	ND
Dissolved Oxygen	1.0 mg/L minimum				5/week	Grab	4.2	10.4	5.13 - 8.68	4.2	9.1	5.66 - 7.93
Chlorine, Total Residual			0.5	NA	2/week	Grab	0.1	0.49	0.18 - 0.27	0.2	0.48	0.37 - 0.43
Solids, Settleable	NA	NA	1.0 mL/L	NA	2/week	Grab						

Table E-1: (continued)

Outfall 004

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2004			2005		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow	Report MGD		Report MGD		5/week	Instantaneous	3472	64917	12569.16 - 22042.68	1942	36452	14530.16 - 19771.35
pH	6.0 to 9.0				5/week	Grab	6.4	7.4	6.93 - 7.00	6	7.2	6.38 - 6.94
BOD	30	NA	45	NA	2/month	Composite	0.5	9.39	1.40 - 5.53	1.39	15.75	1.43 - 8.65
Nitrogen, Ammonia Total	5	NA	8	NA	2/month	Composite	ND	9.8	ND - 4.9	ND	4.56	ND - 2.56
Fecal Coliform	30	NA	45	NA	2/month	Composite	2	66	2 - 34	ND	6	ND
TSS	200/100 mL	NA	400/100 mL	NA	2/month	Grab						
E. Coli	NA	NA	126/100 mL	NA	3/week	Grab	2	104	2 - 30.92	1	88	2 - 15.66
Dissolved Oxygen	1.0 mg/L minimum				5/week	Grab	3.9	9	4.45 - 7.78	5	10.9	5.88 - 9.26
Chlorine, Total Residual			0.5	NA	2/week	Grab	0.21	0.49	0.40 - 0.45	0.22	0.49	0.39 - 0.43
Solids, Settleable	NA	NA	1.0 mL/L	NA	2/week	Grab						

Outfall 005

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2000			2001		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		1/month	Estimate	ND	0.314	ND	0.169	0.488	0.169 - 0.488
pH	6.5 to 9.0				1/month	Grab	ND	7.8	ND	7.2	8.6	7.2 - 8.6
Oil & Grease	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
Temperature, Effluent	Report (Degrees C)				1/month	Grab	ND	25.6	ND	4.8	29.2	4.8 - 29.2

Table E-1: (continued)

Outfall 005

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2002			2003		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		1/month	Estimate	0.001	1.002	0.001 - 0.658	0.014	5.001	0.014 - 5.001
pH	6.5 to 9.0				1/month	Grab	6.9	8.1	6.9 - 8.1	6.8	8.4	6.8 - 8.4
Oil & Grease	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
Temperature, Effluent	Report (Degrees C)				1/month	Grab	11.2	29	12.75 - 29	10.8	24.6	10.8 - 24.6

Outfall 005

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2004			2005		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		1/month	Estimate	0.014	1.41	0.014 - 1.41	0.014	0.687	0.014 - 0.687
pH	6.5 to 9.0				1/month	Grab	7	7.8	7 - 7.8	6.8	7.7	6.8 - 7.7
Oil & Grease	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
Temperature, Effluent	Report (Degrees C)				1/month	Grab	7	23.1	7 - 23.1	8	26.3	8 - 26.3

Outfall 006

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2000			2001		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		1/quarter	Estimate	0.13	0.13	0.13 - 0.13	ND	0.13	ND
pH	6.5 to 9.0				1/quarter	Grab	6.8	7.9	6.8 - 7.9	ND	7.27	ND
1,1-Dichloroethene	NA	NA	0.005	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
Methylene Chloride	NA	NA	0.025	NA	1/quarter	Grab	ND	6.88	ND - 6.88	ND	2.25	ND - 2.25

Table E-1: (continued)

Outfall 006

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2002			2003		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		1/quarter	Estimate	0.13	0.13	0.13 - 0.13	0.13	0.13	0.13 - 0.13
pH	6.5 to 9.0				1/quarter	Grab	6.3	6.8	6.3 - 6.8	6.5	7	6.5 - 7
1,1-Dichloroethene	NA	NA	0.005	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
Methylene Chloride	NA	NA	0.025	NA	1/quarter	Grab	ND	ND	ND	ND	1.34	ND - 1.34

Outfall 006

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2004			2005		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		1/quarter	Estimate	0.13	0.13	0.13 - 0.13	0.13	0.138	0.13 - 0.138
pH	6.5 to 9.0				1/quarter	Grab	6.5	7.6	6.5 - 7.6	6.5	7.7	6.5 - 7.7
1,1-Dichloroethene	NA	NA	0.005	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
Methylene Chloride	NA	NA	0.025	NA	1/quarter	Grab	ND	ND	ND	ND	2.44	ND - 2.44

Outfall 007

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2000			2001		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		1/month	Estimate	ND	0.508	ND - 0.508	ND	22.505	ND - 22.505
pH	6.5 to 9.0				1/month	Grab	ND	7.9	ND	ND	7.7	ND

Table E-1: (continued)

Outfall 007

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2002			2003		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		1/month	Estimate	ND	1.09	ND - 1.09	ND	31.635	ND - 31.635
pH	6.5 to 9.0				1/month	Grab	ND	7.4	ND	ND	7.6	ND

Outfall 007

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2004			2005		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		1/month	Estimate	0.01	2.847	0.01 - 2.847	ND	1.09	ND - 1.09
pH	6.5 to 9.0				1/month	Grab	7	7.6	7 - 7.6	ND	7.7	ND

Outfall 008

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2000			2001		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		1/quarter	Estimate	0.0288	0.048	0.028 - 0.048	0.022	0.036	0.022736 - 0.036
pH	6.0 to 9.0				1/quarter	Grab	7.2	8	7.2 - 8	7.6	8	7.6 - 8
Temperature, Effluent	Report (Degrees C)				1/quarter	Grab	16.5	27	16.5 - 27	17.2	23	17.2 - 23

Table E-1: (continued)

Outfall 008

Effluent Characteristic	Monthly Average Concentration (mg/L)	Average Amount (lb/day)	Daily Maximum Concentration (mg/L)	Maximum Amount (lb/day)	Monitoring Requirements: Frequency	Monitoring Requirements: Sample Type	2002 Minimum Reported Value	2002 Maximum Reported Value	2002 Range of Average Reported Values	2003 Minimum Reported Value	2003 Maximum Reported Value	2003 Range of Average Reported Values
Flow			Report MGD		1/quarter	Estimate	ND	0.0648	0.0021 - 0.064	0.01	3	0.01 - 3
pH	6.0 to 9.0				1/quarter	Grab	7.1	7.9	7.1 - 7.9	7.1	8.1	7.1 - 8.1
Temperature, Effluent	Report (Degrees C)				1/quarter	Grab	17.7	28	17.7 - 28	16	24.3	16 - 24.3

Outfall 008

Effluent Characteristic	Monthly Average Concentration (mg/L)	Average Amount (lb/day)	Daily Maximum Concentration (mg/L)	Maximum Amount (lb/day)	Monitoring Requirements: Frequency	Monitoring Requirements: Sample Type	2004 Minimum Reported Value	2004 Maximum Reported Value	2004 Range of Average Reported Values	2005 Minimum Reported Value	2005 Maximum Reported Value	2005 Range of Average Reported Values
Flow			Report MGD		1/quarter	Estimate	0.001	0.01	0.001 - 0.01	0.001	0.01	0.001 - 0.01
pH	6.0 to 9.0				1/quarter	Grab	6.9	7.7	6.9 - 7.7	7	7.4	7 - 7.4
Temperature, Effluent	Report (Degrees C)				1/quarter	Grab	11	23.7	11 - 23.7	16.2	26.5	16.2 - 26.5

Internal Monitoring Point 01A Main Sewage Treatment Plant Effluent

Effluent Characteristic	Monthly Average Concentration (mg/L)	Average Amount (lb/day)	Daily Maximum Concentration (mg/L)	Maximum Amount (lb/day)	Monitoring Requirements: Frequency	Monitoring Requirements: Sample Type	2000 Minimum Reported Value	2000 Maximum Reported Value	2000 Range of Average Reported Values	2001 Minimum Reported Value	2001 Maximum Reported Value	2001 Range of Average Reported Values
Flow	Report MGD		Report MGD		Continuous	Recorder	0.004	0.76	0.14 - 0.27	0.003	0.67	0.098 - 0.230
pH	6.0 to 9.0				5/week	Grab	6.7	8.2	6.98 - 7.25	6.5	7.6	6.78 - 7.11
BOD	30	NA	45	NA	3/week	Composite	1.33	15.45	3.29 - 7.31	2.73	13.64	2.38 - 7.69
TSS	30	NA	45	NA	3/week	Composite						
Fecal Coliform	200/100 mL	NA	400/100 mL	NA	3/week	Grab	2	199	15.53 - 49.64	1	138	2.26 - 41.53
E. Coli	NA	NA	126/100 mL	NA	3/week	Grab	ND	ND	ND	ND	ND	ND
Solids, Settleable	NA	NA	1.0 mL/L	NA	5/week	Grab	0	0	0 - 0	0	0	0 - 0.01

Table E-1: (continued)

Internal Monitoring Point 01A Main Sewage Treatment Plant Effluent

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2002			2003		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow	Report MGD		Report MGD		Continuous	Recorder	0.058	0.66	0.17 - 0.33	0.011	0.67	0.106 - 0.38
pH	6.0 to 9.0				5/week	Grab	6.4	8.2	6.77 - 7.31	6.6	7.8	6.85 - 7.08
BOD	30	NA	45	NA	3/week	Composite	1	22.85	2.79 - 7.38	1.2	14.14	2.81 - 6.26
TSS	30	NA	45	NA	3/week	Composite						
Fecal Coliform	200/100 mL	NA	400/100 mL	NA	3/week	Grab	2	120	5 - 37.14	2	188	3.14 - 39.28
E. Coli	NA	NA	126/100 mL	NA	3/week	Grab	ND	ND	ND	0	60	0 - 20.71
Solids, Settleable	NA	NA	1.0 mL/L	NA	5/week	Grab	0	0.1	0 - 0.004	0	0	0 - 0

Internal Monitoring Point 01A Main Sewage Treatment Plant Effluent

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2004			2005		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow	Report MGD		Report MGD		Continuous	Recorder	0.02	0.725	0.08 - 0.21	0.017	0.39	0.08 - 0.22
pH	6.0 to 9.0				5/week	Grab	6.6	7.5	6.86 - 7.12	6.6	7.9	6.88 - 7.15
BOD	30	NA	45	NA	3/week	Composite	0	0	0 - 0	0	0	0 - 0
TSS	30	NA	45	NA	3/week	Composite						
Fecal Coliform	200/100 mL	NA	400/100 mL	NA	3/week	Grab	1	97	4.84 - 28	0	110	
E. Coli	NA	NA	126/100 mL	NA	3/week	Grab	0	0	0 - 0	0	0	0 - 0
Solids, Settleable	NA	NA	1.0 mL/L	NA	5/week	Grab	0	0	0 - 0	0	0	0 - 0

Table E-1: (continued)

Internal Monitoring Point 01B (to Outfall 001) Treated Groundwater - ASTF

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2000			2001		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		1/quarter	Estimate	ND	0.813	0.083 - 0.606	ND	0.819	0.025 - 0.21
pH		Report			1/quarter	Grab	7.2	7.8	7.36 - 7.72	6.7	8.3	6.8 - 7.725
Trichloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	1902.51	ND - 380.77	ND	372.01	ND - 156.49

Internal Monitoring Point 01B (to Outfall 001) Treated Groundwater - ASTF

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2002			2003		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		1/quarter	Estimate	ND	0.855	0.071 - 0.20	ND	0.96	0.038 - 0.30
pH		Report			1/quarter	Grab	6.1	7.8	6.25 - 7.66	ND	8.9	ND
Trichloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	10.5	ND - 3.79	ND	695.6	ND - 115.93

Internal Monitoring Point 01B (to Outfall 001) Treated Groundwater - ASTF

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2004			2005		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		1/quarter	Estimate	ND	0.98	0.051 - 0.47	ND	1.23	0.15 - 0.60
pH		Report			1/quarter	Grab	6.4	7.4	6.4 - 7.4	ND	7.9	ND
Trichloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	8.68	ND - 2.59	ND	31.6	ND - 8.6

Table E-1: (continued)

Internal Monitoring Point 01C (to Outfall 001) Site 1 Remediated Groundwater

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2000			2001		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		1/quarter	Estimate	ND	0.088	0.049 - 0.069	ND	0.089	0.057 - 0.067
pH	Report				1/quarter	Grab	ND	7.5	ND	ND	7.2	ND
1,1-Dichloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
Trichloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	2.23	ND
Tetrachloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	2.22	ND

Internal Monitoring Point 01C (to Outfall 001) Site 1 Remediated Groundwater

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2002			2003		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		1/quarter	Estimate	ND	0.099	0.038 - 0.065	ND	0.13	0.017 - 0.068
pH	Report				1/quarter	Grab	ND	7.2	ND	ND	7.5	ND
1,1-Dichloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
Trichloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
Tetrachloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND

Table E-1: (continued)

Internal Monitoring Point 01C (to Outfall 001) Site 1 Remediated Groundwater

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2004			2005		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		1/quarter	Estimate	ND	0.124	0.013 - 0.06	ND	0.11	0.016 - 0.06
pH		Report			1/quarter	Grab	ND	7.3	ND	ND	6.9	ND
1,1-Dichloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	2.08	ND
1,1,1-Trichloroethane	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	2.37	ND
Trichloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	3.46	ND
Tetrachloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND

Internal Monitoring Point 01D (to Outfall 001) Site 22 Remediated Groundwater

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2000			2001		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		1/quarter	Estimate	0.57	0.57	0.57 - 0.57	ND	0.57	ND
pH		Report			1/quarter	Grab	7.2	8.3	7.2 - 8.3	ND	8.1	ND
1,1-Dichloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
Trichloroethene	NA	NA	Report	NA	1/quarter	Grab	1.45	57.33	1.45 - 57.33	ND	11.07	ND - 11.07
Tetrachloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	3.28	ND - 3.28	ND	ND	ND

Table E-1: (continued)

Internal Monitoring Point 01D (to Outfall 001) Site 22 Remediated Groundwater

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2002			2003		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		1/quarter	Estimate	0.57	0.57	0.57 - 0.57	0.57	0.57	0.57 - 0.57
pH	Report				1/quarter	Grab	6.5	7.8	6.5 - 7.8	7.05	7.9	7.05 - 7.9
1,1-Dichloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
Trichloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	20.19	ND - 20.19	2.12	50.85	2.12 - 50.85
Tetrachloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	5.32	ND - 5.32	ND	1.29	ND - 1.29

Internal Monitoring Point 01D (to Outfall 001) Site 22 Remediated Groundwater

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2004			2005		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		1/quarter	Estimate	0.57	0.57	0.57 - 0.57	0.57	0.57	0.57 - 0.57
pH	Report				1/quarter	Grab	7.3	8.1	7.3 - 8.1	7.1	8.3	7.1 - 8.3
1,1-Dichloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
Trichloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	54.85	ND - 54.85	ND	11.64	ND - 11.64
Tetrachloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	2.27	ND - 2.27	ND	2.54	ND - 2.54

Table E-1: (continued)

Internal Monitoring Point 01E (to Outfall 001) AC&T Site Remediated Groundwater

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2000			2001		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		1/quarter	Estimate	ND	ND	ND	ND	ND	ND
pH		Report			1/quarter	Grab	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
Trichloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
Tetrachloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND

Internal Monitoring Point 01E (to Outfall 001) AC&T Site Remediated Groundwater

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2002			2003		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		1/quarter	Estimate	ND	ND	ND	ND	0.02	ND
pH		Report			1/quarter	Grab	ND	ND	ND	ND	8.26	ND
1,1-Dichloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
Trichloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	4.22	ND - 4.22
Tetrachloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND

Table E-1: (continued)

Internal Monitoring Point 01E (to Outfall 001) AC&T Site Remediated Groundwater

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2004			2005		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		1/quarter	Estimate	0.0053	0.039	0.0053 - 0.039	0.0003	0.025	0.0003 - 0.025
pH		Report			1/quarter	Grab	ND	8.2	ND	6.27	8.39	6.27 - 8.39
1,1-Dichloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
Trichloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
Tetrachloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND

Internal Monitoring Point 02A (to Outfall 001) Site 8 Remediated Groundwater

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2000			2001		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow	Report MGD		Report MGD		1/quarter	Estimate	0.05	0.05	0.05 - 0.05	ND	0.05	ND
pH		Report			1/quarter	Grab	5	6	5 - 6	ND	5.6	ND
1,1,1-Trichloroethane	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
Tetrachloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	2.15	ND - 2.15	ND	2.31	ND - 2.31

Table E-1: (continued)

Internal Monitoring Point 02A (to Outfall 001) Site 8 Remediated Groundwater

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2002			2003		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow	Report MGD		Report MGD		1/quarter	Estimate	0.05	0.5	0.05 - 0.5	0.05	0.05	0.05 - 0.05
pH	Report				1/quarter	Grab	3	4.5	3 - 4.5	4.38	4.5	4.38 - 4.5
1,1,1-Trichloroethane	NA	NA	Report	NA	1/quarter	Grab	ND	ND	ND	ND	ND	ND
Tetrachloroethene	NA	NA	Report	NA	1/quarter	Grab	ND	2.35	ND - 2.35	ND	52.27	ND - 52.27

Internal Monitoring Point 02A (to Outfall 001) Site 8 Remediated Groundwater

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2004			2005		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow	Report MGD		Report MGD		1/quarter	Estimate	0.05	0.05	0.05 - 0.05	0.05	0.05	0.05 - 0.05
pH	Report				1/quarter	Grab	4.4	5.4	4.4 - 5.4	4.9	5.6	4.9 - 5.6
1,1,1-Trichloroethane	NA	NA	Report	NA	1/quarter	Grab	ND	1.92	ND - 1.92	ND	ND	ND
Tetrachloroethene	NA	NA	Report	NA	1/quarter	Grab	1.3	39.05	1.3 - 39.05	ND	4.66	ND - 4.66

Table E-1: (continued)

Outfall SW2 (Outfall SW 2 discharges only in response to exceptionally large storm events that exceed the pumping station capacity)

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2000			2001		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		Semi-annual	Recorder	0.83	226.62	0.83 - 226.62	58.96	5909.06	58.96 - 5909.06
pH		Report			Semi-annual	Grab	7.6	8.56	7.6 - 8.56	7.22	7.8	7.22 - 7.8
BOD5	NA	NA	Report	NA	Semi-annual	Grab	5	5	5 - 5	5	13	5 - 13
COD	NA	NA	Report	NA	Semi-annual	Grab	20	25	20 - 25	20	20	20 - 20
TSS	NA	NA	Report	NA	Semi-annual	Grab	3	9	3 - 9	5	195.7	5 - 195.7
Oil & Grease	NA	NA	Report	NA	Semi-annual	Grab	5	5	5 - 5	5	6.3	5 - 6.3

Outfall SW2 (Outfall SW 2 discharges only in response to exceptionally large storm events that exceed the pumping station capacity)

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2002			2003		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		Semi-annual	Recorder	13.03	20.3	13.03 - 20.30	1333.73	2693.38	1333.73 - 2693.38
pH		Report			Semi-annual	Grab	7.2	7.31	7.2 - 7.31	7.23	7.6	7.23 - 7.6
BOD5	NA	NA	Report	NA	Semi-annual	Grab	3.1	3.9	3.1 - 3.9	2	2	2 - 2
COD	NA	NA	Report	NA	Semi-annual	Grab	21	25	21 - 25	20	20	20 - 20
TSS	NA	NA	Report	NA	Semi-annual	Grab	3	5.8	3 - 5.8	16	19	16 - 19
Oil & Grease	NA	NA	Report	NA	Semi-annual	Grab	0.38	5	0.38 - 5	0.52	0.9	0.52 - 0.9

Table E-1: (continued)

Outfall SW2 (Outfall SW 2 discharges only in response to exceptionally large storm events that exceed the pumping station capacity)

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2004			2005		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		Semi-annual	Recorder	ND	ND	ND	2.31	6.99	2.31 - 6.99
pH	Report				Semi-annual	Grab	ND	ND	ND	6.85	6.97	6.85 - 6.97
BOD5	NA	NA	Report	NA	Semi-annual	Grab	ND	ND	ND	0.5	18.9	0.5 - 18.9
COD	NA	NA	Report	NA	Semi-annual	Grab	ND	ND	ND	3	68	3 - 68
TSS	NA	NA	Report	NA	Semi-annual	Grab	ND	ND	ND	3.7	17.9	3.7 - 17.9
Oil & Grease	NA	NA	Report	NA	Semi-annual	Grab	ND	ND	ND	0.5	1.5	0.5 - 1.5

Outfall SW3 (includes Outfall 005) (Outfall SW3 discharges only in response to exceptionally large storm events that exceed the pumping station capacity)

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2000			2001		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		Semi-annual	Recorder	309.03	1134	309.03 - 1134	884.29	71482.17	884.29 - 71482.17
pH	Report				Semi-annual	Grab	7.34	7.6	7.34 - 7.6	6.87	8.32	6.87 - 8.32
BOD5	NA	NA	Report	NA	Semi-annual	Grab	5	5	5 - 5	5	5	5 - 5
COD	NA	NA	Report	NA	Semi-annual	Grab	20	33	20 - 33	20	28	20 - 28
TSS	NA	NA	Report	NA	Semi-annual	Grab	4	66.2	4 - 66.2	4.4	406.1	4.4 - 406.1
Oil & Grease	NA	NA	Report	NA	Semi-annual	Grab	5	5	5 - 5	5	5	5 - 5

Table E-1: (continued)

Outfall SW3 (includes Outfall 005) (Outfall SW3 discharges only in response to exceptionally large storm events that exceed the pumping station capacity)

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2002			2003		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		Semi-annual	Recorder	661.8	661.8	661.8 - 661.8	308.8	308.8	308.8 - 308.8
pH		Report			Semi-annual	Grab	7.6	7.6	7.6 - 7.6	7.38	7.38	7.38 - 7.38
BOD5	NA	NA	Report	NA	Semi-annual	Grab	1	1	1 - 1	3.9	3.9	3.9 - 3.9
COD	NA	NA	Report	NA	Semi-annual	Grab	20	20	20 - 20	20	20	20 - 20
TSS	NA	NA	Report	NA	Semi-annual	Grab	5.1	5.1	5.1 - 5.1	4	4	4 - 4
Oil & Grease	NA	NA	Report	NA	Semi-annual	Grab	5	5	5 - 5	0.48	0.48	0.48 - 0.48

Outfall SW3 (includes Outfall 005) (Outfall SW3 discharges only in response to exceptionally large storm events that exceed the pumping station capacity)

Effluent Characteristic	Monthly Average Concentration	Average Amount	Daily Maximum Concentration	Maximum Amount	Monitoring Requirements		2004			2005		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)	Frequency	Sample Type	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values	Minimum Reported Value	Maximum Reported Value	Range of Average Reported Values
Flow			Report MGD		Semi-annual	Recorder	5690.8	9619.1	5690.8 - 9619.1	273.5	469.8	273.5 - 469.8
pH		Report			Semi-annual	Grab	6.66	7.4	6.66 - 7.4	6.87	7.28	6.87 - 7.28
BOD5	NA	NA	Report	NA	Semi-annual	Grab	2	2.6	2 - 2.6	0.5	1.62	0.5 - 1.62
COD	NA	NA	Report	NA	Semi-annual	Grab	20	38	20 - 38	3	14	3 - 14
TSS	NA	NA	Report	NA	Semi-annual	Grab	21	44	21 - 44	4	5	4 - 5
Oil & Grease	NA	NA	Report	NA	Semi-annual	Grab	0.78	0.8	0.78 - 0.8	0.5	0.9	0.5 - 0.9

APPENDIX E

AEDC Title V Air Permit

STATE OF TENNESSEE
TENNESSEE DEPARTMENT OF ENVIRONMENT & CONSERVATION
DIVISION OF AIR POLLUTION CONTROL
9TH FLOOR, L & C ANNEX
401 CHURCH STREET
NASHVILLE, TN 37243-1531

May 9, 2002

Certified Mail 7000 1530 0001 6242 5330
Return Receipt Requested

Larry V. Judge, Captain, USN
Arnold Engineering Development Center
100 Kindel Drive
Arnold Air Force Base, TN 37389

Re: 16-0010

Dear Captain Judge:

Please find enclosed your Title V Major Source Operating Permit Number 546264. This permit consists of 34 pages and two attachments. The following table summarizes important dates associated with your Title V Permit:

Permit **Issue Date**	May 9, 2002
Annual Allowable Based Emission Fees for the present Annual Accounting Period (see paragraph E1)	**Present Annual Accounting Period**-- July 1, 2001 to June 30, 2002 **Billing Date**--April 1, 2002. **Due Date**--July 1, 2002.
Annual Actual Emission Analysis: (see paragraph E1)	**Analysis Period**--July 1, 2002 to June 30, 2003 and each subsequent year. **Due Date**—July 1, 2003 and each subsequent year.
Annual Actual Based Emission Fees: (see paragraph E1)	**Calculation Date**-- July 1, 2003 and each subsequent year. **Due Date**--July 1, 2003 and each subsequent year.
TAPCD Semiannual Report: (see paragraph E2)	**Report Period**— July 1, 2002 to December 31, 2002 and each 6-month period thereafter **Due Date**—March 1, 2003 and each 6-month period thereafter.
TAPCD Annual Compliance Certification: (see paragraph E2)	**Compliance Period**--July 1, 2002 to June 30, 2003 and each subsequent year. **Due Date**—August 29, 2003 and each subsequent year
Application **Renewal Period**	**between** August 11, 2006 and November 9, 2006
Permit **Expiration Date**	May 8, 2007

Please note that penalties associated with noncompliance with any of the requirements of this Title V permit are significant. If you violate any of the requirements of this permit, you may be subject to a civil penalty of up to $25,000.00 (TWENTY FIVE THOUSAND DOLLARS) PER DAY FOR EACH DAY OF VIOLATION.

If you have any questions about this permit, please call Stan Lodl at (615) 532-0546.

Sincerely,

Lacey J Hardin

Barry R. Stephens, P.E.
Technical Secretary

TENNESSEE AIR POLLUTION CONTROL BOARD
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
NASHVILLE, TENNESSEE 37243-1531

OPERATING PERMIT (TITLE V) Issued Pursuant to Tennessee Air Quality Act

This permit fulfills the requirements of Title V of the Federal Clean Air Act (42 U.S.C. 7661a-7661e) and the federal regulations promulgated thereunder at 40 CFR Part 70. (FR Vol. 57, No. 140, Tuesday, July 21, 1992 p.32295-32312). This permit is issued in accordance with the provisions of paragraph 1200-3-9-.02(11) of the Tennessee Air Pollution Control Regulations. The permittee has been granted permission to operate an air contaminant source in accordance with emission limitations and monitoring requirements set forth herein.

Date Issued: May 9, 2002

Date Expires: May 8, 2007

Permit Number:
546264

Issued To:
Arnold Engineering Development Center

Installation Address:
100 Kindel Drive
Arnold Air Force Base

Installation Description:
Flight simulation test facilities with aerodynamic and propulsion wind tunnels, rocket and turbine engine test cells, space environments chambers, arc heaters, ballistic ranges and other specialized units. (See next page for details)

Emission Source Reference No.: 16-0010

Renewal Application Due Date: Between: August 11, 2006
and November 9, 2006

Primary SIC: 97

Responsible Official:
Name: Larry V. Judge, Captain, USN
Title: Vice Commander Arnold Engineering Development Center

Facility Contact Person:
Name: Frank Duncan
Title: Deputy Chief Environmental Mgt.
Phone: (931) 454-7252

Information Relied Upon:
Application dated November 15, 1996 and
Revisions dated January 23, 1997,
August 4, 1997, May 29, 1998, June 22, 1999,
August 20, 1999, May 30, 2000 and June 1, 2000

(continued on the next page)

TECHNICAL SECRETARY

No Authority is Granted by this Permit to Operate, Construct, or Maintain any Installation in Violation of any Law, Statute, Code, Ordinance, Rule, or Regulation of the State of Tennessee or any of its Political Subdivisions.

POST OR FILE AT INSTALLATION ADDRESS

Installation Description:

Source Number: **Description:**

01, 02, 03, 04: Steam Plant A, Boilers 01, 02, 03, 04
05: Steam Plant B, Boiler 05
06: ETF Heaters (North Heater)(South Heater) Provide heated air for testing operations.
07: VKF Heaters (Heater W15) (Heater W16) (Heater W17) (Heater W18) (Process Heater)
08: PWT Air Dryer
14: APTU Test Facility, Vitiated Air Heaters, SUE Burner or Gas Generator, for Testing Solid and Liquid Rocket Motors as well as Turbine Engines.
17: Liquid Rocket Testing. This testing may be conducted either in 16-0010-17 Liquid Rocket Test Cell Facility, 16-0010-18 Solid Rocket Test Cell Facility, 16-0010-19 ETF Test Cells, or 16-0010-31 ASTF Test Cells
18: Solid Rocket Testing. This testing may be conducted either in 16-0010-18 Solid Rocket Test Cell Facility, 16-0010-19 ETF Test Cells, or 16-0010-31 ASTF Test Cells, as well as enclosed chambers, such as the J6 dehumidification chamber, within the Solid Rocket Test Complex.
19: ETF Test Cells (Including Glycol Reboilers A & B)
21: Bulk Fuel Storage Facility
22: Motor Pool/Steamplant Storage Tanks
28: HB1 Heaters 1A & 1B
30: ASTF Heaters
31 ASTF Test Cells And Glycol Reboilers EG-A & EG-B
35: VKF Auxiliary Heater
38: I & M Spray Paint Booth
40: Chemical Cleaning Facility
41: Research Heater
42: ARC Heaters (3)
43: Steamplant C
45: ASTF Air Strippers
46: T-3 Air Heater
49: Classified Waste Incinerators
50: ARC Heaters, H3 & H4
52: PWT Engine Testing
53: SL1 Test Cell
54: Westinghouse Combustor Test Rig
55: Test Fuel Storage Facility
56: SL2/SL3 Test Cells
67: AC&T Air Stripper

CONTENTS

SECTION A
GENERAL PERMIT CONDITIONS

SECTION B
GENERAL CONDITIONS for MONITORING, REPORTING, and ENFORCEMENT

CONTENTS

SECTION C
PERMIT CHANGES

SECTION D
GENERAL APPLICABLE REQUIREMENTS

CONTENTS

SECTION E

SOURCE SPECIFIC EMISSION STANDARDS, OPERATING LIMITATIONS, and MONITORING, RECORDKEEPING and REPORTING REQUIREMENTS

SECTION A

GENERAL PERMIT CONDITIONS

A permit issued under the provisions of paragraph 1200-3-9-.02(11) is a permit issued pursuant to the requirements of Title V of the Federal Act and its implementing Federal regulations promulgated at 40 CFR, Part 70.

A1. **Definitions.** Terms not otherwise defined in the permit shall have the meaning assigned to such terms in the referenced regulation.

TAPCR 1200-3

A2. **Compliance requirement.** All terms and conditions in a permit issued pursuant to paragraph 1200-3-9-.02(11) including any provisions designed to limit a source's potential to emit, are enforceable by the Administrator and citizens under the Federal Act.

The permittee shall comply with all conditions of its permit. Except for requirements specifically designated herein as not being federally enforceable (State Only), non-compliance with the permit requirements is a violation of the Federal Act and the Tennessee Air Quality Act and is grounds for enforcement action; for a permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application. Non-compliance with permit conditions specifically designated herein as not being federally enforceable (State Only) is a violation of the Tennessee Air Quality Act and may be grounds for these actions.

TAPCR 1200-3-9-.02(11)(e)2(i) and 1200-3-9-.02(11)(e)1(vi)(I)

A3. **Need to halt or reduce activity.** The need to halt or reduce activity is not a defense for noncompliance. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of the permit. However, nothing in this item shall be construed as precluding consideration of a need to halt or reduce activity as a mitigating factor in assessing penalties for noncompliance if the health, safety or environmental impacts of halting or reducing operations would be more serious than the impacts of continuing operations.

TAPCR 1200-3-9-.02(11)(e)1(vi)(II)

A4. **The permit.** The permit may be modified, revoked, reopened, and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or of a notification of planned changes or anticipated noncompliance does not stay any permit condition.

TAPCR 1200-3-9-.02(11)(e)1(vi)(III)

A5. **Property rights.** The permit does not convey any property rights of any sort, or any exclusive privilege.

TAPCR 1200-3-9-.02(11)(e)1(vi)(IV)

A6. **Submittal of requested information.** The permittee shall furnish to the Technical Secretary, within a reasonable time, any information that the Technical Secretary may request in writing to determine whether cause exists for modifying, revoking and reissuing, or termination of the permit or to determine compliance with the permit. Upon request, the permittee shall also furnish to the Technical Secretary copies of records required to be kept by the permit. If the permittee claims that such information is confidential, the Technical Secretary may review that claim and hold the information in protected status until such time that the Board can hear any contested proceedings regarding confidentiality disputes. If the information is desired by EPA, the permittee may mail the information directly to EPA. Any claims of confidentiality for federal purposes will be determined by EPA.

TAPCR 1200-3-9-.02(11)(e)1(vi)(V)

A7. <u>**Severability clause.**</u> The requirements of this permit are severable. A dispute regarding one or more requirements of this permit does not invalidate or otherwise excuse the permittee from their duty to comply with the remaining portion of the permit.

TAPCR 1200-3-9.02(11)(e)1(v)

A8. <u>**Fee payment.**</u>

(a) The permittee shall pay an annual major source emission fee based upon the responsible official's choice of actual emissions or allowable emissions. An emission cap of 4,000 tons per year per regulated pollutant per major source SIC Code shall apply to actual or allowable based emission fees. A major source annual emission fee will not be charged for emissions in excess of the cap (s) or for carbon monoxide.

(b) Major sources who have filed a timely, complete operating permit application in accordance with 1200-3-9-.02(11), shall pay allowable emission based fees until the beginning of the next annual accounting period following receipt of their major source operating permit. At that time, the permittee shall begin paying their annual emission fee based upon their choice of actual or allowable based fees, or mixed actual and allowable based fees as stated under SECTION E of this permit. Once permitted, altering the existing choice shall be accomplished by a written request of the major source, filed in the office of the Technical Secretary at least one hundred eighty days prior to the expiration or reissuance of the major source operating permit.

(c) Major sources must conform to the following requirements with respect to fee payments:

1. If a major source choosing an allowable based annual emission fee wishes to restructure its allowable emissions for the purposes of lowering its annual emission fees, a mutually agreed upon, more restrictive regulatory requirement may be established to minimize the allowable emissions and thus the annual emission fee. The more restrictive requirement must be specified on the permit, and must include the method used to determine compliance with the limitation. The documentation procedure to be followed by the major source must also be included to insure that the limit is not exceeded. Restructuring the allowable emissions is permissible only in the annual accounting periods of eligibility and only, if the written request for restructuring is filed with the Technical Secretary at least 120 days prior to the beginning of the annual accounting period of eligibility. These periods of eligibility occur upon expiration of the initial major source operating permit, renewal of an expired major source operating permit or reissuance of a major source operating permit.

2. Beginning with the annual accounting period beginning July 1, 1997 to June 30, 1998, major sources paying on allowable based emission fees will be billed by the Division no later than April 1 prior to the end of the accounting period. The major source annual emission fee is due July 1 following the end of the accounting period.

3. Beginning with the annual accounting period beginning July 1, 1997 to June 30, 1998, major sources choosing an actual based annual emission fee shall file an actual emissions analysis with the Technical Secretary which summarizes the actual emissions of all regulated pollutants at the air contaminant sources of their facility. Based upon the actual emissions analysis, the source shall calculate the fee due and submit the payment and the analysis each July 1st following the end of the annual accounting period.

4. Beginning with the annual accounting period beginning July 1,1997 to June 30, 1998, major sources choosing a mixture of allowable and actual based emission fees shall file an actual emissions and allowable emissions analysis with the Technical Secretary which summarizes the actual and allowable emissions of all regulated pollutants at the air contaminant sources of their facility. Based upon the analysis, the source shall calculate the fee due and submit the payment and the analysis each July 1st following the end of the annual accounting period.

The mixed based fee shall be calculated utilizing the 4,000 ton cap specified in subparagraph 1200-3-26-.02(2)(i). In determining the tonnages to be applied toward the regulated pollutant 4,000 ton cap in a mixed based fee, the source shall first calculate the actual emission based fees for a regulated pollutant and apply that tonnage toward the regulated pollutant's cap. The remaining tonnage available in the 4,000 ton category of a regulated pollutant shall be subject to allowable emission based fee calculations for the sources that were not included in the actual emission based fee calculations. Once the 4,000 ton cap has been reached for a regulated pollutant, no additional fee shall be required.

5. Major sources choosing to pay their major source annual emission fee based on actual based emissions or a mixture of allowable and actual based emissions may request an extension of time to file their emissions analysis with the Technical Secretary. The extension may be granted by the Technical Secretary up to ninety (90) days. The request for extension must be postmarked no later than July 1 or the request for extension shall be denied. The request for extension to file must state the reason and give an adequate explanation.

An estimated annual emission fee payment of no less than eighty percent (80%) of the fee due July 1 must accompany the request for extension to avoid penalties and interest on the underpayment of the annual emission fee. A remaining balance due must accompany the emission analysis. If there has been an overpayment, a refund may be requested in writing to the Division or be applied as a credit toward next year's major source annual emission fee. The request for extension of time is not available to major sources choosing to pay their major source annual emission fee based on allowable emissions.

6. Newly constructed major sources or minor existing sources modifying their operations such that they become a major source in the midst of the standard July 1st to June 30th annual accounting period, shall pay allowable based annual emission fees for the fractional remainder of the annual accounting period commencing upon their start-up. At the beginning of the next annual accounting period, the "responsible official" of the source may choose to pay annual emission fees based on actual or allowable emissions or a mixture of the two as provided for in this rule 1200-3-26-.02.

(d) Where more than one (1) allowable emission limit is applicable to a regulated pollutant, the allowable emissions for the regulated pollutants shall not be double counted. Major sources subject to the provisions of paragraph 1200-3-26-.02(9) shall apportion their emissions as follows to ensure that their fees are not double counted.

1. Sources that are subject to federally promulgated hazardous air pollutant standards that can be imposed under Chapter 1200-3-11 or Chapter 1200-3-31 will place such regulated emissions in the specific hazardous air pollutant under regulation. If the pollutant is also in the family of volatile organic compounds or the family of particulates, the pollutant shall not be placed in that respective family category.

2. A miscellaneous category of hazardous air pollutants shall be used for hazardous air pollutants listed at part 1200-3-26-.02(2)(i)12 that do not have an allowable emission standard. A pollutant placed in this category shall not be subject to being placed in any other category such as volatile organic compounds or particulates.

3. Each individual hazardous air pollutant and the miscellaneous category of hazardous air pollutants is subject to the 4,000 ton cap provisions of subparagraph 1200-3-26-.02(2)(i).

4. Major sources that wish to pay annual emission fees for PM_{10} on an allowable emission basis may do so if they have a specific PM_{10} allowable emission standard. If a major source has a total particulate emission standard, but wishes to pay annual emission fees on an actual PM_{10} emission basis, it may do so if the PM_{10} actual emission levels are proven to the satisfaction of the Technical Secretary. The method to demonstrate the actual PM_{10} emission levels must be made as part of the source's major source operating permit in advance in order to exercise this option. The PM_{10} emissions reported under these options shall not be subject to fees under the family of particulate emissions. The 4,000 ton cap provisions of subparagraph 1200-3-26-.02(2)(i) shall also apply to PM_{10} emissions.

TAPCR 1200-3-26-.02 (3) and (9) and 1200-3-9-.02(11)(e)1(vii)

A9. **Permit revision not required.** A permit revision will not be required under any approved economic incentives, marketable permits, emissions trading and other similar programs or process for changes that are provided for in the permit.

TAPCR 1200-3-9-.02(11)(e)1(viii)

A10. **Inspection and entry.** Upon presentation of credentials and other documents as may be required by law, the permittee shall allow the Technical Secretary or his authorized representative to perform the following for the purposes of determining compliance with the permit applicable requirements:

(a) Enter upon, at reasonable times, the permittee's premises where a source is located or emissions-related activity is conducted, or where records must be kept under the conditions of the permit;

(b) Have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit;

(c) Inspect at reasonable times any facilities, equipment (including monitoring and air pollution control equipment), practices, or operations regulated or required under the permit; and

(d) As authorized by the Clean Air Act and Chapter 1200-3-10 of TAPCR, sample or monitor at reasonable times substances or parameters for the purpose of assuring compliance with the permit or applicable requirements.

(e) "Reasonable times" shall be considered to be customary business hours unless reasonable cause exists to suspect noncompliance with the Act, Division 1200-3 or any permit issued pursuant thereto and the Technical Secretary specifically authorizes an inspector to inspect a facility at any other time.

TAPCR 1200-3-9-.02(11)(e)3.(ii)

A11. **Permit shield.**

(a) Compliance with the conditions of this permit shall be deemed compliance with all applicable requirements as of the date of permit issuance, provided that:

1. Such applicable requirements are included and are specifically identified in the permit; or

2. The Technical Secretary, in acting on the permit application or revision, determines in writing that other requirements specifically identified are not applicable to the source, and the permit includes the determination or a concise summary thereof.

(b) Nothing in this permit shall alter or affect the following:

1. The provisions of section 303 of the Federal Act (emergency orders), including the authority of the Administrator under that section. Similarly, the provisions of T.C.A. §68-201-109 (emergency orders) including the authority of the Governor under the section;

2. The liability of an owner or operator of a source for any violation of applicable requirements prior to or at the time of permit issuance;

3. The applicable requirements of the acid rain program, consistent with section 408(a) of the Federal Act; or

4. The ability of EPA to obtain information from a source pursuant to section 114 of the Federal Act.

(c) Permit shield is granted to the permittee.

A12. <u>Permit renewal and expiration.</u>

(a) Permit expiration terminates the source's right to operate unless a timely and complete renewal application has been submitted at least 180 days, but no more than 270 days prior to the expiration of this permit.

(b) Provided that the permittee submits a timely and complete application for permit renewal the source will not be considered in violation of paragraph 1200-3-9-.02(11) until the Technical Secretary takes final action on the permit application, except as otherwise noted in paragraph 1200-3-9-.02(11).

(c) This permit, its shield provided in Condition A11, and its conditions will be extended and effective after its expiration date provided that the source has submitted a timely, complete renewal application to the Technical Secretary.

TAPCR 1200-3-9-.02(11)(f)3 and 2, 1200-3-9-.02(11)(d)1(i)(III), and 1200-3-9-.02(11)(a)2

A13. <u>Reopening for cause.</u>

(a) A permit shall be reopened and revised prior to the expiration of the permit under any of the circumstances listed below:

1. Additional applicable requirements under the Federal Act become applicable to the sources contained in this permit provided the permit has a remaining term of 3 or more years. Such a reopening shall be completed not later than 18 months after promulgation of the applicable requirement. No such reopening is required if the effective date of the requirement is later than the permit expiration date of this permit, unless the original has been extended pursuant to 1200-3-9-.02(11)(a)2.

2. Additional requirements become applicable to an affected source under the acid rain program.

3. The Technical Secretary or EPA determines that the permit contains a material mistake or that inaccurate statements were made in establishing the emissions standards or other terms or conditions of the permit.

4. The Technical Secretary or EPA determines that the permit must be revised or revoked to assure compliance with the applicable requirements.

(b) Proceedings to reopen and issue a permit shall follow the same proceedings as apply to initial permit issuance and shall affect only those parts of the permit for which cause to reopen exists, and not the entire permit. Such reopening shall be made as expeditiously as practicable.

(c) Reopenings for cause shall not be initiated before a notice of such intent is provided to the permittee by the Technical Secretary at least 30 days in advance of the date that the permit is to be reopened except that the Technical Secretary may provide a shorter time period in the case of an emergency. An emergency shall be established by the criteria of T.C.A. 68-201-109 or other compelling reasons that public welfare is being adversely affected by the operation of a source that is in compliance with its permit requirements.

(d) If the Administrator finds that cause exists to terminate, modify, or revoke and reissue a permit as identified in A13, he is required under federal rules to notify the Technical Secretary and the permittee of such findings in writing. Upon receipt of such notification, the Technical Secretary shall investigate the matter in order to determine if he agrees or disagrees with the Administrator's findings. If he agrees with the Administrator's findings, the Technical Secretary shall conduct the reopening in the following manner:

1. The Technical Secretary shall, within 90 days after receipt of such notification, forward to EPA a proposed determination of termination, modification, or revocation and reissuance, as appropriate. If the Administrator grants additional time to secure permit applications or additional information from the permittee, the Technical Secretary shall have the additional time period added to the standard 90 day time period.

2. EPA will evaluate the Technical Secretary's proposed revisions and respond as to their evaluation.

3. If EPA agrees with the proposed revisions, the Technical Secretary shall proceed with the reopening in the same manner prescribed under Condition A13 (b) and Condition A13 (c).

4. If the Technical Secretary disagrees with either the findings or the Administrator that a permit should be reopened or an objection of the Administrator to a proposed revision to a permit submitted pursuant to Condition A13(d), he shall bring the matter to the Board at its next regularly scheduled meeting for instructions as to how he should proceed. The permittee shall be required to file a written brief expressing their position relative to the Administrator's objection and have a responsible official present at the meeting to answer questions for the Board. If the Board agrees that EPA is wrong in their demand for a permit revision, they shall instruct the Technical Secretary to conform to EPA's demand, but to issue the permit under protest preserving all rights available for litigation against EPA.

TAPCR 1200-3-9-.02(11)(f)6 and 7.

A14. **Permit transference.** An administrative permit amendment allows for a change of ownership or operational control of a source where the Technical Secretary determines that no other change in the permit is necessary, provided that the following requirements are met:

(a) Transfer of ownership permit application is filed consistent with the provisions of 1200-3-9-.03(6), and

(b) written agreement containing a specific date for transfer of permit responsibility, coverage, and liability between the current and new permittee has been submitted to the Technical Secretary.

TAPCR 1200-3-9-.02(11)(f)4(i)(IV) and 1200-3-9-.03(6)

A15. **Air pollution alert.** When the Technical Secretary has declared that an air pollution alert, an air pollution warning, or an air pollution emergency exists, the permittee must follow the requirements for that episode level as outlined in TAPCR 1200-3-9-.03(1) and TAPCR 1200-3-15-.03.

A16. **Construction permit required.** Except as exempted in TAPCR 1200-3-9-.04, TAPCR 1200-3-9-.02(11)(f)5, and sources considered insignificant under TAPCR 1200-3-9-.04(5), this facility shall not begin the construction of a new air contaminant source or the modification of an air contaminant source which may result in the discharge of air contaminants without first having applied for and received from the Technical Secretary a construction permit for the construction or modification of such air contaminant source.

TAPCR 1200-3-9-.01(1)(a)

A17. **Notification of changes.** The permittee shall notify the Technical Secretary 30 days prior to commencement of any of the following changes to an air contaminant source which would not be a modification requiring a construction permit.

(a) change in air pollution control equipment

(b) change in stack height or diameter

(c) change in exit velocity of more than 25 percent or exit temperature of more than 15 percent based on absolute temperature.

TAPCR 1200-3-9-.02(7)

A18. **Schedule of compliance.** The permittee will comply with any applicable requirement that becomes effective during the permit term on a timely basis. If the permittee is not in compliance the permittee must submit a schedule for coming into compliance which must include a schedule of remedial measure(s), including an enforceable set of deadlines for specific actions.
TAPCR 1200-3-9-.02(11)(d)3 and 40 CFR Part 70.5(c)

A19. **<u>Title VI.</u>**

(a) The permittee shall comply with the standards for recycling and emissions reduction pursuant to 40 CFR, Part 82, Subpart F, except as provided for motor vehicle air conditioners (MVACs) in Subpart B:

1. Persons opening appliances for maintenance, service, repair, or disposal must comply with the required practices pursuant to Section 82.156.

2. Equipment used during the maintenance, service, repair, or disposal of appliances must comply with the standards for recycling and recovery equipment pursuant to Section 82.158.

3. Persons performing maintenance, service, repair, or disposal of appliances must be certified by an approved technician certification program pursuant to Section 82.161.

(b) If the permittee performs a service on motor (fleet) vehicles when this service involves ozone depleting substance refrigerant in the motor vehicle air conditioner (MVAC), the permittee is subject to all the applicable requirements as specified in 40 CFR, Part 82, Subpart B, Servicing of Motor Vehicle Air Conditioners.

(c) The permittee shall be allowed to switch from any ozone-depleting substance to any alternative that is listed in the Significant New Alternatives Program(SNAP) promulgated pursuant to 40 CFR, Part 82, Subpart G, Significant New Alternatives Policy Program.

A20. <u>112 (r).</u> The permittee shall comply with the requirement to submit to the Administrator or designated State Agency a risk management plan, including a registration that reflects all covered processes, by June 21, 1999, if the permittee's facility is required pursuant to 40 CFR, 68, to submit such a plan.

SECTION B

GENERAL CONDITIONS for MONITORING, REPORTING, and ENFORCEMENT

B1. **Recordkeeping.** Monitoring and related record keeping shall be performed in accordance with the requirements specified in the permit conditions for each individual permit unit. In no case shall reports of any required monitoring and record keeping be submitted less frequently than at least 180 days.

(a) Where applicable, records of required monitoring information include the following:

1. The date, place as defined in the permit, and time of sampling or measurements;
2. The date(s) analyses were performed;
3. The company or entity that performed the analysis;
4. The analytical techniques or methods used;
5. The results of such analyses; and
6. The operating conditions as existing at the time of sampling or measurement.

(b) Digital data accumulation which utilizes valid data compression techniques shall be acceptable for compliance determination as long as such compression does not violate an applicable requirement and its use has been approved in advance by the Technical Secretary.

TAPCR 1200-3-9-.02(11)(e)1(iii)

B2. **Retention of monitoring data.** The permittee shall retain records of all required monitoring data and support information for a period of at least 5 years from the date of the monitoring sample, measurement, report, or application. Support information includes all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, and copies of all reports required by the permit.

TAPCR 1200-3-9.02(11)(e)1(iii)(II)II

B3. **Reporting.** Reports of any required monitoring and record keeping shall be submitted to the Technical Secretary in accordance with the frequencies specified in the permit conditions for each individual permit unit. Reporting periods will be dated from the end of the first complete calendar quarter following issuance of this permit unless otherwise noted. Reports shall be submitted within 60 days of the close of the reporting period unless otherwise noted. All instances of deviations from permit requirements must be clearly identified in such reports. All required reports must be certified by a responsible official. Reports required under "State only requirements" are not required to be certified by a responsible official.

TAPCR 1200-3-9-.02(11)(e)1(iii)

B4. **Certification.** Except for reports required under "State Only" requirements, any application form, report or compliance certification submitted pursuant to the requirements of this permit shall contain certification by a responsible official of truth, accuracy and completeness. This certification shall state that, based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate and complete.

TAPCR 1200-3-9-.02(11)(d)4

B5. **Annual compliance certification.** The permittee shall submit annually compliance certifications with terms and conditions contained in Sections D and E of this permit, including emission limitations, standards, or work practices. This compliance certification shall include all of the following (provided that the identification of applicable information may cross-reference the permit or previous reports, as applicable):

(a) The identification of each term or condition of the permit that is the basis of the certification;

(b) The identification of the method(s) or other means used by the owner or operator for determining the compliance status with each term and condition during the certification period;

(c) Whether such method(s) or other means provide continuous or intermittent data. Such methods and other means shall include, at a minimum, the methods and means required by this permit If necessary, the owner or operator also shall identify any other material information that must be included in the certification to comply with section 113(c)(2) of the Federal Act, which prohibits knowingly making a false certification or omitting material information;

(d) The status of compliance with the terms and conditions of the permit for the period covered by the certification, based on the method or means designated in B5(b) above. The certification shall identify each deviation and take it into

account in the compliance certification. The certification shall also identify as possible exceptions to compliance any periods during which compliance is required and in which an excursion* or exceedance** as defined below occurred; and
(e) Such other facts as the Technical Secretary may require to determine the compliance status of the source.

* "Excursion" shall mean a departure from an indicator range established for monitoring under this paragraph, consistent with any averaging period specified for averaging the results of the monitoring.
** "Exceedance" shall mean a condition that is detected by monitoring that provides data in terms of an emission limitation or standard and that indicates that emissions (or opacity) are greater than the applicable emission limitation or standard (or less than the applicable standard in the case of a percent reduction requirement) consistent with any averaging period specified for averaging the results of the monitoring.

40 CFR Part 70.6(c)(5)(iii) as amended in the Federal Register Vol.62, No.204, October 22, 1997, pages 54946 and 54947

B6. __**Submission of compliance certification.**__ The compliance certification shall be submitted to:

The Technical Secretary
Division of Air Pollution Control
ATTN: Operating Permits Program
9th Floor, L & C Annex
401 Church Street
Nashville, Tennessee 37243-1531,

and

Air and EPCRA Enforcement Branch
US EPA Region IV
61 Forsyth Street, SW
Atlanta, Georgia 30303

TAPCR 1200-3-9-.02(11)(e)3(v)(IV)

B7. __**Emergency provisions.**__ An emergency constitutes an affirmative defense to an enforcement action brought against this source for noncompliance with a technology based emission limitation due to unavoidable increases in emissions attributable to the emergency. An emergency shall not include noncompliance to the extent caused by improperly designed equipment, lack of preventative maintenance, careless or improper operation, or operator error.
(a) The affirmative defense of the emergency shall be demonstrated through properly signed, contemporaneous operating logs, or other relevant evidence that:
1. An emergency occurred and that the permittee can identify the probable cause(s) of the emergency. "Probable" must be supported by a credible investigation into the incident that seeks to identify the causes and results in an explanation supported by generally accepted engineering or scientific principles.
2. The permitted source was at the time being properly operated. In determining whether or not a source was being properly operated, the Technical Secretary shall examine the source's written standard operating procedures which were in effect at the time of the noncompliance and any other code as detailed below that would be relevant to preventing the noncompliance. Adherence to the source's standard operating procedures will be the test of adequate preventative maintenance, careless operation, improper operation or operator error to the extent that such adherence would prevent noncompliance. The source's failure to follow recognized standards of practice to the extent that adherence to such a standard would have prevented noncompliance will disqualify the source from any claim of an emergency and an affirmative defense.
3. During the period of the emergency, the permittee took all reasonable steps to minimize levels of emissions that exceeded the emission standards, or other requirements in the permit.
4. The permittee submitted notice of the emergency to the Technical Secretary according to the notification criteria for malfunctions in rule 1200-3-20-.03. For the purposes of this condition, "emergency" shall be substituted for "malfunction(s)" in rule 1200-3-20-.03 to determine the relevant notification threshold. The notice shall include a description of the emergency, any steps taken to mitigate emissions, and corrective actions taken.
(b) In any enforcement proceeding the permittee seeking to establish the occurrence of an emergency has the burden of proof.
(c) The provisions of this condition are in addition to any emergency, malfunction or upset requirement contained in Division 1200-3 or other applicable requirement.

TAPCR 1200-3-9-.02(11)(e)7

B8. __**Excess emissions reporting.**__
(a) The permittee shall promptly notify the Technical Secretary when any emission source, air pollution control equipment, or related facility breaks down in such a manner to cause the emission of air contaminants in excess of the applicable emission standards contained in Division 1200-3 or any permit issued thereto, or of sufficient duration to cause

damage to property or public health. The permittee must provide the Technical Secretary with a statement giving all pertinent facts, including the estimated duration of the breakdown. Violations of the visible emission standard which occur for less than 20 minutes in one day (midnight to midnight) need not be reported. Prompt notification will be within 24 hours of the malfunction and shall be provided by telephone to the Division's Nashville office. The Technical Secretary shall be notified when the condition causing the failure or breakdown has been corrected. In attainment and unclassified areas if emissions other than from sources designated as significantly impacting on a nonattainment area in excess of the standards will not and do not occur over more than a 24-hour period (or will not recur over more than a 24-hour period) and no damage to property and or public health is anticipated, notification is not required.

(b) Any malfunction that creates an imminent hazard to health must be reported by telephone immediately to the Division's Nashville office and to the State Civil Defense.

(c) A log of all malfunctions, startups, and shutdowns resulting in emissions in excess of the standards in Division 1200-3 or any permit issued thereto must be kept at the plant. All information shall be entered in the log no later than twenty-four (24) hours after the startup or shutdown is complete, or the malfunction has ceased or has been corrected. Any later discovered corrections can be added in the log as footnotes with the reason given for the change. This log must record at least the following:

1. Stack or emission point involved
2. Time malfunction, startup, or shutdown began and/or when first noticed
3. Type of malfunction and/or reason for shutdown
4. Time startup or shutdown was complete or time the air contaminant source returned to normal operation
5. The company employee making entry on the log must sign, date, and indicate the time of each log entry

The information under items 1. and 2. must be entered into the log by the end of the shift during which the malfunction or startup began. For any source utilizing continuous emission(s) monitoring, continuous emission(s) monitoring collection satisfies the above log keeping requirement.

TAPCR 1200-3-20-.03 and .04

B9. **<u>Malfunctions, startups and shutdowns - reasonable measures required.</u>** The permittee must take all reasonable measures to keep emissions to a minimum during startups, shutdowns, and malfunctions. These measures may include installation and use of alternate control systems, changes in operating methods or procedures, cessation of operation until the process equipment and/or air pollution control equipment is repaired, maintaining sufficient spare parts, use of overtime labor, use of outside consultants and contractors, and other appropriate means. Failures that are caused by poor maintenance, careless operation or any other preventable upset condition or preventable equipment breakdown shall not be considered malfunctions. This provision does not apply to standards found in 40 CFR, Parts 60(Standards of performance for new stationary sources), 61(National emission standards for hazardous air pollutants) and 63(National emission standards for hazardous air pollutants for source categories).

TAPCR 1200-3-20-.02

B10. **<u>Sources located in non-attainment areas or having significant impact on air quality in a non-attainment area.</u>** The owner or operator of all sources located in non-attainment areas or having a significant impact on air quality in a non-attainment area (for the pollutant designated) must submit a report to the Technical Secretary within thirty (30) days after the end of each calendar quarter listing the times at which malfunctions, startups and/or shutdowns, which resulted in emissions greater than any applicable emission limits and the estimated amount of emissions discharged during such times. This report shall also include total emissions during the quarter and be reported in a format specified by the Technical Secretary.

TAPCR 1200-3-20-.04(2)

B11. **<u>Report required upon the issuance of a notice of violation for excess emissions.</u>** The permittee must submit within twenty (20) days after receipt of the notice of violation, the data shown below to assist the Technical Secretary in deciding whether to excuse or validate the violation. If this data has previously been available to the Technical Secretary prior to the issuance of the notice of violation no further action is required of the violating source. However, if the source desires to submit additional information, then this must be submitted within the same twenty (20) day time period. The minimum data requirements are:

(a) The identity of the stack and/or other emission point where the excess emission(s) occurred;

(b) The magnitude of the excess emissions expressed in pounds per hour and the units of the applicable emission limitation and the operating data and calculations used in determining the magnitude of the excess emissions;

(c) The time and duration of the emissions;

(d) The nature and cause of such emissions;

(e) For malfunctions, the steps taken to correct the situation and the action taken or planned to prevent the recurrence of such malfunctions;

(f) The steps taken to limit the excess emissions during the occurrence reported, and

(g) If applicable, documentation that the air pollution control equipment, process equipment, or processes were at all times maintained and operated in a manner consistent with good operating practices for minimizing emissions.

Failure to submit the required report within the twenty (20) day period specified shall preclude the admissibility of the data for consideration of excusal for malfunctions.

TAPCR 1200-3-20-.06(2),(3) and (4)

SECTION C

PERMIT CHANGES

C1. **Operational flexibility changes.** The source may make operational flexibility changes that are not addressed or prohibited by the permit without a permit revision subject to the following requirements:

(a) The change cannot be subject to a requirement of Title IV of the Federal Act or Chapter 1200-3-30.

(b) The change cannot be a modification under any provision of Title I of the federal Act or Division 1200-3.

(c) Each change shall meet all applicable requirements and shall not violate any existing permit term or condition.

(d) The source must provide contemporaneous written notice to the Technical Secretary and EPA of each such change, except for changes that are below the threshold of levels that are specified in Rule 1200-3-9-.04.

(e) The change shall not qualify for a permit shield under the provisions of part 1200-3-9-.02(11)(e)6.

(f) The permittee shall keep a record describing the changes made at the source that result in emissions of a regulated air pollutant subject to an applicable requirement, but not otherwise regulated under the permit, and the emissions resulting from those changes. The records shall be retained until the changes are incorporated into subsequently issued permits.

TAPCR 1200-3-9-.02(11)(a)4 (ii)

C2. **Section 502(b)(10) changes.**

(a) The permittee can make certain changes without requiring a permit revision, if the changes are not modifications under Title I of the Federal Act or Division 1200-3 and the changes do not exceed the emissions allowable under the permit. The permittee must, however, provide the Administrator and Technical Secretary with written notification within a minimum of 7 days in advance of the proposed changes. The Technical Secretary may waive the 7 day advance notice in instances where the source demonstrates in writing that an emergency necessitates the change. Emergency shall be demonstrated by the criteria of TAPCR 1200-3-9-.02(11)(e)7 and in no way shall it include changes solely to take advantages of an unforeseen business opportunity. The Technical Secretary and EPA shall attach each such notice to their copy of the relevant permit.

(b) The written notification must include the following:

1. brief description of the change within the permitted facility;
2. specifies the date on which the change will occur;
3. declares any change in emissions; and
4. declares any permit term or condition that is no longer applicable as a result of the change.

(c) The permit shield provisions of TAPCR 1200-3-9-.02(11)(e)6 shall not apply to Section 502(b)(10) changes.

TAPCR 1200-3-9-.02(11)(a)4 (i)

C3. **Administrative amendment.**

(a) Administrative permit amendments to this permit shall be in accordance with 1200-3-9-.02(11)(f)4. The source may implement the changes addressed in the request for an administrative amendment immediately upon submittal of the request.

(b) The permit shield shall be extended as part of an administrative permit amendment revision consistent with the provisions of TAPCR 1200-3-9-.02(11)(e)6 for such revisions made pursuant to item (c) of this condition which meet the relevant requirements of TAPCR 1200-3-9-.02(11)(e), TAPCR 1200-3-9-.02(11)(f) and TAPCR 1200-3-9-.02(11)(g) for significant permit modifications.

(c) Proceedings to review and grant administrative permit amendments shall be limited to only those parts of the permit for which cause to amend exists, and not the entire permit.

TAPCR 1200-3-9-.02(11)(f)4

C4. Minor permit modifications.

(a) The permittee may submit an application for a minor permit modification in accordance with TAPCR 1200-3-9-.02(11)(f)5(ii).

(b) The permittee may make the change proposed in its minor permit modification immediately after an application is filed with the Technical Secretary.

(c) Proceedings to review and modify permits shall be limited to only those parts of the permit for which cause to modify exists, and not the entire permit.

(d) Minor permit modifications do not qualify for a permit shield.

TAPCR 1200-3-9-.02(11)(f)5(ii)

C5. Significant permit modifications.

(a) The permittee may submit an application for a significant modification in accordance with TAPCR 1200-3-9-.02(11)(f)5(iv).

(b) Proceedings to review and modify permits shall be limited to only those parts of the permit for which cause to modify exists, and not the entire permit.

TAPCR 1200-3-9-.02(11)(f)5(iv)

C6. New construction or modifications.

Future construction at this source that is subject to the provisions of TAPCR 1200-3-9-.01 shall be governed by the following:

(a) The permittee shall designate in their construction permit application the route that they desire to follow for the purposes of incorporating the newly constructed or modified sources into their existing operating permit. The Technical Secretary shall use that information to prepare the operating permit application submittal deadlines in their construction permit.

(b) Sources desiring the permit shield shall choose the administrative amendment route of TAPCR 1200-3-9-.02(11)(f)4 or the significant modification route of TAPCR 1200-3-9-.02(11)(f)5(iv).

(c) Sources desiring expediency instead of the permit shield shall choose the minor permit modification procedure route of TAPCR 1200-3-9-.02(f)5(ii) or group processing of minor modifications under the provisions of TAPCR 1200-3-9-.02(11)5(iii) as applicable to the magnitude of their construction.

TAPCR 1200-3-9-.02(11)(d) 1(i)(V)

SECTION D

GENERAL APPLICABLE REQUIREMENTS

D1. **Visible emissions.** With the exception of air emission sources exempt from the requirements of TAPCR Chapter 1200-3-5 and air emission sources for which a different opacity standard is specifically provided elsewhere in this permit, the permittee shall not cause, suffer, allow or permit discharge of a visible emission from any air contaminant source with an opacity in excess of twenty (20) percent for an aggregate of more than five (5) minutes in any one (1)hour or more than twenty (20) minutes in any twenty-four (24) hour period; provided, however, that for fuel burning installations with fuel burning equipment of input capacity greater than 600 million btu per hour, the permittee shall not cause, suffer, allow, or permit discharge of a visible emission from any fuel burning installation with an opacity in excess of twenty (20) percent (6-minute average) except for one six minute period per one (1) hour of not more than forty (40) percent opacity. Sources constructed or modified after July 7, 1992 shall utilize 6-minute averaging.

Consistent with the requirements of TAPCR Chapter 1200-3-20, due allowance may be made for visible emissions in excess of that permitted under TAPCR 1200-3-5 which are necessary or unavoidable due to routine startup and shutdown conditions. The facility shall maintain a continuous, current log of all excess visible emissions showing the time at which such conditions began and ended and that such record shall be available to the Technical Secretary or his representative upon his request.

TAPCR 1200-3-5-.01(1), TAPCR 1200-3-5-.03(6) and TAPCR 1200-3-5-.02(1)

D2. **General provisions and applicability for non-process gaseous emissions.** Any person constructing or otherwise establishing a non-portable air contaminant source emitting gaseous air contaminants after April 3, 1972, or relocating an air contaminant source more than 1.0 km from the previous position after November 6, 1988, shall install and utilize the best equipment and technology currently available for controlling such gaseous emissions.

TAPCR 1200-3-6-.03(2)

D3. **Non-process emission standards.** The permittee shall not cause, suffer, allow, or permit particulate emissions from non-process sources in excess of the standards in TAPCR 1200-3-6.

D4. **General provisions and applicability for process gaseous emissions.** Any person constructing or otherwise establishing an air contaminant source emitting gaseous air contaminants after April 3, 1972, or relocating an air contaminant source more than 1.0 km from the previous position after November 6, 1988, shall install and utilize equipment and technology which is deemed reasonable and proper by the Technical Secretary.

TAPCR 1200-3-7-.07(2)

D5. **Particulate emissions from process emission sources.** The permittee shall not cause, suffer, allow, or permit particulate emissions from process sources in excess of the standards in TAPCR 1200-3-7.

D6. **Sulfur dioxide emission standards.** The permittee shall not cause, suffer, allow, or permit Sulfur dioxide emissions from process and non-process sources in excess of the standards in TAPCR 1200-3-14. Regardless of the specific emission standard, new process sources shall utilize the best available control technology as deemed appropriate by the Technical Secretary of the Tennessee Air Pollution Control Board.

D7. **Fugitive Dust.**

(a) The permittee shall not cause, suffer, allow, or permit any materials to be handled, transported, or stored; or a building, its appurtenances, or a road to be used, constructed, altered, repaired, or demolished without taking reasonable precautions to prevent particulate matter from becoming airborne. Such reasonable precautions shall include, but not be limited to, the following:

1. Use, where possible, of water or chemicals for control of dust in demolition of existing buildings or structures, construction operations, grading of roads, or the clearing of land;

2. Application of asphalt, oil, water, or suitable chemicals on dirt roads, material stock piles, and other surfaces which can create airborne dusts;

3. Installation and use of hoods, fans, and fabric filters to enclose and vent the handling of dusty materials. Adequate containment methods shall be employed during sandblasting or other similar operations.

(b) The permittee shall not cause, suffer, allow, or permit fugitive dust to be emitted in such manner to exceed five (5) minutes per hour or twenty (20) minutes per day as to produce a visible emission beyond the property line of the property on which the emission originates, excluding malfunction of equipment as provided in Chapter 1200-3-20.

TAPCR 1200-3-8

D8. **Open burning.** The permittee shall comply with the TAPCR 1200-3-4-.04 for all open burning activities at the facility.

TAPCR 1200-3-4

D9. **Asbestos.** Where applicable, the permittee shall comply with the requirements of 1200-3-11-.02(d) when conducting any renovation or demolition activities at the facility.

TAPCR 1200-3-11-.02(d) and 40 CFR, Part 61

D10. **Annual certification of compliance.** The generally applicable requirements set forth in Section D of this permit are intended to apply to activities and sources that are not subject to source-specific applicable requirements contained in State of Tennessee and U.S. EPA regulations. By annual certification of compliance, the permittee shall be considered to meet the monitoring and related record keeping and reporting requirements of TAPCR 1200-3-9-.02(11)(e)1.(iii) and 1200-3-10-.04(2)(b)1 and compliance requirements of TAPCR 1200-3-9-.02(11)(e)3.(i). The permittee shall submit compliance certification for these conditions annually.

SECTION E

SOURCE SPECIFIC EMISSION STANDARDS, OPERATING LIMITATIONS, and MONITORING, RECORDKEEPING and REPORTING REQUIREMENTS

16-0010	Facility Description	Arnold Engineering Development Center is a complex of flight simulation test facilities with aerodynamic and propulsion wind tunnels, rocket and turbine engine test cells, space environments chambers, arc heaters, ballistic ranges and other specialized units.

Conditions E1 through 3-3 apply to all sources in Section E of this permit unless otherwise noted.

E1. **Fee Payment :** Actual Emissions.

FEE EMISSIONS SUMMARY TABLE FOR MAJOR SOURCE 16-0010

REGULATED POLLUTANTS	ALLOWABLE EMISSIONS (tons per AAP)	ACTUAL EMISSIONS (tons per AAP)	COMMENTS
PARTICULATE MATTER (PM)	N/A	AEAR	Includes all fee emissions.
PM_{10}	N/A	N/A	N/A
SO_2	N/A	AEAR	Includes all fee emissions.
VOC	N/A	AEAR	Includes all fee emissions.
NO_X	N/A	AEAR	Includes all fee emissions.
CATEGORY OF MISCELLANEOUS HAZARDOUS AIR POLLUTANTS (HAP WITHOUT A STANDARD)*			
VOC FAMILY GROUP	N/A	AEAR	Included in VOC above
NON-VOC GASEOUS GROUP	N/A	AEAR	
PM FAMILY GROUP	N/A	AEAR	Included in PM above
CATEGORY OF SPECIFIC HAZARDOUS AIR POLLUTANTS (HAP WITH A STANDARD)**			
VOC FAMILY GROUP	N/A	N/A	
NON-VOC GASEOUS GROUP	N/A	N/A	
PM FAMILY GROUP	N/A	N/A	
CATEGORY OF NSPS POLLUTANTS NOT LISTED ABOVE***			
EACH NSPS POLLUTANT NOT LISTED ABOVE	N/A	N/A	

NOTES

AAP The **Annual Accounting Period (AAP)** is a twelve (12) consecutive month period that **begins each July 1st and ends June 30th of the following year**. The **present Annual Accounting Period began July 1, 2001 and ends June 30, 2002.** The **next Annual Accounting Period begins July 1, 2002 and ends June 30, 2003.**

N/A indicates that no emissions are specified for fee computation.

AEAR indicates that an Actual **E**missions **A**nalysis is **R**equired to determine the actual emissions of:

(1) **each regulated pollutant** (Particulate matter, SO_2, VOC, NO_X and so forth. See TAPCR 1200-3-26-.02(2)(i) for the definition of a regulated pollutant.),

(2) **each pollutant group** (VOC Family, Non-VOC Gaseous, and Particulate Family), and

(3) the **Miscellaneous HAP Category**

under consideration during the **Annual Accounting Period**.

* **Category Of Miscellaneous HAP (HAP Without A Standard):** This category is made-up of hazardous air pollutants that do not have a federal or state standard. Each HAP is classified into one of three groups, the **VOC Family** group, **the Non-VOC Gaseous** group, or the **Particulate (PM) Family** group. **For fee computation**, the **Miscellaneous HAP Category** is subject to the 4,000 ton cap provisions of subparagraph 1200-3-26-.02(2)(i).

** **Category Of Specific HAP (HAP With A Standard):** This category is made-up of hazardous air pollutants (HAP) that are subject to Federally promulgated Hazardous Air Pollutant Standards that can be imposed under Chapter 1200-3-11 or Chapter 1200-3-31. Each individual hazardous air pollutant is classified into one of three groups, the **VOC Family** group, **the Non-VOC Gaseous** group, or the **Particulate (PM) Family** group. **For fee computation**, each individual hazardous air pollutant of the **Specific HAP Category** is subject to the 4,000 ton cap provisions of subparagraph 1200-3-26-.02(2)(i).

*** **Category Of NSPS Pollutants Not Listed Above:** This category is made-up of each New Source Performance Standard (NSPS) pollutant whose emissions are not included in the **PM, SO_2, VOC** or **NO_X** emissions from each source in this permit. **For fee computation**, each **NSPS pollutant not listed above** is subject to the 4,000 ton cap provisions of subparagraph 1200-3-26-.02(2)(i).

END NOTES

The permittee shall:

(1) Pay annual **allowable based emission fees** for the **present Annual Accounting Period.**

(2) Pay major source annual **actual based emission fees**, as requested by the responsible official, beginning July 1, **2002** of the **next annual accounting period.**

(3) Prepare an **actual emissions analysis** beginning July 1, **2002** in accordance with the above **Fee Emissions Summary Table.** The **actual emissions analysis** shall include:

- (a) the completed **Fee Emissions Summary Table,**
- (b) each **AEAR** required by the above **Fee Emissions Summary Table, and**
- (c) summaries of the calculations used to complete the **AEARs** required by the above **Fee Emissions Summary Table**. The Technical Secretary may request records used as the basis for calculations if deemed necessary.

(4) Submit the **actual emissions analysis** at the time the fees are paid in full.

(5) Calculate the fee due based upon the **actual emissions analysis**, and submit the payment on July 1st following the end of the **annual accounting period.** If any part of any fee imposed under TAPCR 1200-3-26-.02 is not paid within fifteen (15) days of the due date, penalties shall at once accrue as specified in TAPCR 1200-3-26-.02(8). Major sources may request an extension of time to file their emissions analysis with the Technical Secretary as specified in Condition A8(c)5 of this permit. Emissions for regulated pollutants shall not be double counted as specified in Condition A8(d) of this permit.

Payment of the fee due and the actual emissions analysis shall be submitted to The Technical Secretary at the address in Condition E2(b) of this permit.

TAPCR 1200-3-26-.02 (3) and (9), and 1200-3-9-.02(11)(e)1 (iii) and (vii)

E2. **Reporting requirements**.

(a) **Semiannual reports** The first report shall cover the 6-month period from July 1, 2002 to December 31, 2002 and shall be submitted within 60 days after the 6-month period which is March 1, 2003 Subsequent reports shall be submitted within 60 days after the end of each 6-month period following the first report.

These semiannual reports shall include:

(1) Any monitoring and recordkeeping required by Conditions E4-10, E5-5, E19-2, and E20-1 of this permit. However, a summary report of this data is acceptable provided there is sufficient information to enable the Technical Secretary to evaluate compliance.

(2) The visible emission evaluation readings from Conditions E3-1 and E3-2 of this permit if required. However, a summary report of this data is acceptable provided there is sufficient information to enable the Technical Secretary to evaluate compliance.

(3) Identification of all instances of deviations from **ALL PERMIT REQUIREMENTS**.

These reports must be certified by a responsible official consistent with condition B4 of this permit and shall be submitted to The Technical Secretary at the address in Condition E2(b) of this permit.

TAPCR 1200-3-9-.02(11)(e)1.(iii)

(b) **Annual compliance certification** The permittee shall submit annually compliance certifications with terms and conditions contained in Sections A.B. D and E of this permit, including emission limitations, standards, or work practices. This compliance certification shall include all of the following (provided that the identification of applicable information may cross-reference the permit or previous reports, as applicable):

(1) The identification of each term or condition of the permit that is the basis of the certification;

(2) The identification of the method(s) or other means used by the owner or operator for determining the compliance status with each term and condition during the certification period;

(3) Whether such method(s) or other means provide continuous or intermittent data. Such methods and other means shall include, at a minimum, the methods and means required by this permit. If necessary, the owner or operator also shall identify any other material information that must be included in the certification to comply with section 113(c)(2) of the Federal Act, which prohibits knowingly making a false certification or omitting material information;

(4) The status of compliance with the terms and conditions of the permit for the period covered by the certification, based on the method or means designated in E2(b)2 above. The certification shall identify each deviation and take it into account in the compliance certification. The certification shall also identify as possible exceptions to compliance any periods during which compliance is required and in which an excursion* or exceedance** as defined below occurred; and

(5) Such other facts as the Technical Secretary may require to determine the compliance status of the source.

* "Excursion" shall mean a departure from an indicator range established for monitoring under this paragraph, consistent with any averaging period specified for averaging the results of the monitoring.

** "Exceedance" shall mean a condition that is detected by monitoring that provides data in terms of an emission limitation or standard and that indicates that emissions (or opacity) are greater than the applicable emission limitation or standard (or less than the applicable standard in the case of a percent reduction requirement) consistent with any averaging period specified for averaging the results of the monitoring.
The first certification shall cover the 12-month period from July 1, 2002 to June 30, 2003 and shall be submitted within 60 days after the end of the 12-month period, August 29, 2003. Subsequent certifications shall be submitted within 60 days after the end of each 12-month period following the first certification.

These certifications shall be submitted to:

The Technical Secretary
Division of Air Pollution Control
ATTN: Operating Permits Program
9th Floor, L & C Annex
401 Church Street
Nashville, Tennessee 37243-1531

and

Air and EPCRA Enforcement Branch
US EPA Region IV
61 Forsyth Street, SW
Atlanta, Georgia 30303

40 CFR Part 70.6(c)(5)(iii) as amended in the Federal Register Vol.62, No.204, October 22, 1997, pages 54946 and 54947

E3. **General Permit Requirements.**

E3-1. Visible emissions for sources 02, 03, 04, 05, 06, 07, 18, 21, 22, 28, 30, 38, 40, 43, 45 and 46 shall not exceed 20% opacity except for 5 minutes per hour up to 20 minutes per day as specified in Rule 1200-3-5-.01 of the Tennessee Air Pollution Control Regulations (aggregate count). Visible emissions from stacks will be determined by Tennessee Visible Emission Evaluation Method 2 as adopted by the Tennessee Air Pollution Control Board on August 24, 1984.

Compliance Method: Compliance shall be demonstrated according to the opacity matrix, dated June 18, 1996, Attachment #1 of this permit. Monitoring reports shall be submitted on a semiannual basis.

E3-2. Visible emissions for sources 01, 08, 14, 17, 19, 31, 35, 41, 42, 49, 50, 52, 53, 54, 55, 56, 66 and 67 shall not exceed 20% opacity as specified in Rule 1200-3-5-.03(6) of the Tennessee Air Pollution Control. Visible emissions from stacks will be determined by EPA Method 9 as published in the Federal Register, Volume 39, Number 219 on November 12,1974. (6 minute average)

Compliance Method: Compliance shall be demonstrated according to the opacity matrix, dated June 18, 1996, Attachment #1 of this permit. Monitoring reports shall be submitted on a semiannual basis.

If the magnitude and frequency of excursions reported by the permittee in the periodic monitoring for emissions is unsatisfactory to the Technical Secretary, this permit may be reopened to impose additional opacity monitoring requirements.

E3-3. The permittee is placed on notice that Fuel Combustion in Engine Test Facilities, Industrial Boilers and Process Heaters is scheduled for regulation under section 112 of the Clean Air Act for promulgation of MACT (Maximum Achievable Control Technology) Standards by November 15, 2000. The Technical Secretary may re-open this permit in order to add the regulation if applicable.

16-0010-01,02, 03, 04 Steam Plant A, boilers 01, 02, 03, and 04 used for plant operations

Conditions E4-1 through E4-9 apply to sources 16-0010-01, 02, 03, 04.

E4-1. The maximum heat input to boiler 01 shall not exceed 42 MM Btu per hour. This is the capacity of the boiler as stated in the application dated November 15, 1996. The Technical Secretary may require proof of compliance with this limit.

E4-2. Total heat input to boilers 02, 03, and 04 shall not exceed 229.2 million Btu per hour. This is the capacity of the boilers as stated in the application dated November 15, 1996. The Technical Secretary may require proof of compliance with this limit.

E4-3. Combined total operating hours for all four boilers shall not exceed 26,000 hours per State FY (July-June). This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letter dated October 21, 1998.

Compliance Method: Compliance with this emission standard is based on record keeping as specified in Condition E4-10.

E4-4. Natural gas or commingled fuel oil consisting of various combinations of fuels such as JP fuels, aviation fuels, and/or #2 fuel oil shall be the only fuels used for these boilers.

E4-5. Particulate matter emitted from boiler 01 shall not exceed 0.27 pounds per MM Btu (11.4 lb/hr maximum). This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letter dated October 21, 1998.

Compliance Method: The potential Particulate emissions from this source are less than 5 tons per year. By annual certification of compliance, the permittee shall be considered to meet the monitoring and related recordkeeping and reporting requirements of TAPCR 1200-3-9-.02(11)(e)1(iii) and 1200-3-10-.04(2)(b)(1), and the compliance requirements of TAPCR 1200-3-9-.02(11)(e)3(i).

E4-6. Particulate matter emitted from boilers 02, 03, and 04 shall not exceed 5.0 pounds per hour. This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letter dated April 3,1992.

Compliance Method: Compliance with this emission standard is based on calculations utilizing emission factors from EPA AP-42, Attachment #2, Pages E-2 and E-5 of this permit.

E4-7. The sulfur content of the fuel oil shall not exceed 0.3 percent by weight. This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letter dated October 21, 1998.

Compliance Method: Vendor supplied certifications or records of the sulfur content of each batch of fuel. These records must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. These records must be used for annual compliance certification and must be retained for a period of not less than five years.

E4-8. Sulfur dioxide emitted from boiler 01 shall not exceed 0.5 pounds per MM Btu (21 lb/hr maximum) and 39 tons per State FY (July-June). This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letter dated May 2,1990.

Compliance Method: Compliance with this emission standard is based on calculations utilizing emission factors from EPA AP-42, Attachment #2, Pages E-2 and E-5 of this permit. A monthly log of gallons of fuel oil combusted shall be maintained as shown in Condition E4-10. The SO_2 emission rate shall be determined using the following equation:

$$SO_2\ (\text{Tons / yr}) = \left[G \text{ x } \frac{1}{1000} \text{ x } 142 \text{ x } (S) \right] \div 2000 \quad \text{where:}$$

G = Gallons of fuel oil used [July – June],
S = Sulfur content of fuel (in weight percent),

E4-9. Sulfur dioxide emitted from boilers 02, 03 and 04 shall not exceed 53.7 pounds per hour. This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letter dated April 3,1992. A monthly log of gallons of fuel oil combusted shall be maintained as shown in Condition E4-10.

Compliance Method: The SO_2 emission rate shall be determined using the following equation:

$$SO_2\ (\text{lb / hr}) = \left[\frac{GPM}{HPM} \text{ x } \frac{1}{1000} \text{ x } 142 \text{ x } (S) \right] + \left[0.6 \text{ x } \frac{MMCF}{HPMG} \right] \quad \text{where:}$$

GPM = Gallons per month of fuel oil used,
HPM = Hours per month of source operation using fuel oil,
S = Sulfur content of fuel (in weight percent),
MMCF = 10^6 Cubic feet of natural gas used per month, and
HPMG = Hours per month of source operating using natural gas.

E4-10. Monthly fuel oil consumption log.

MONTHLY LOG for source 16-0010-01, 02, 03, 04

Boiler Number:					
Date	Operating Hours	Operating Hours While Using Fuel Oil	Date	Operating Hours	Operating Hours While Using Fuel Oil
1			16		
2			17		
3			18		
4			19		
5			20		
6			21		
7			22		
8			23		
9			24		
10			25		
11			26		
12			27		
13			28		
14			29		
15			30		
			31		

Mo _____, Yr___ Total Fuel Oil Usage _______ Gallons/Month
Sulfur Content _______ Percent by weight

Total Operating Hrs. ___________________
Operating Hrs. using Fuel Oil/Month _______
lb/hr SO_2 for Month _______

16-0010-05 Steam Plant B, Boiler 05 used for plant operations

Conditions E5-1 through E5-5 apply to source 16-0010-05.

E5-1. Total heat input to this boiler shall not exceed 65.6 million Btu per hour. This is the capacity of the boiler as stated in the application dated November 15, 1996. The Technical Secretary may require proof of compliance with this limit.

E5-2. Natural gas or commingled fuel oil consisting of various combinations of fuels such as JP fuels, aviation fuels, and/or #2 fuel oil shall be the only fuels used for these boilers.

E5-3 Particulate matter emitted from this source shall not exceed 2.0 pounds per hour. This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letter dated April 3,1992.

Compliance Method: The potential Particulate emissions from this source are less than 5 tons per year. By annual certification of compliance, the permittee shall be considered to meet the monitoring and related recordkeeping and reporting requirements of TAPCR 1200-3-9-.02(11)(e)1(iii) and 1200-3-10-.04(2)(b)(1), and the compliance requirements of TAPCR 1200-3-9-.02(11)(e)3(i).

E5-4. The sulfur content of the fuel oil shall not exceed 0.3 percent by weight. This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letter dated October 21, 1998.

Compliance Method: Vendor supplied certifications or records of the sulfur content of each batch of fuel. These records must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. These records must be used for annual compliance certification and must be retained for a period of not less than five years.

E5-5. The sulfur dioxide emitted from this source shall not exceed 21.2 pounds per hour. This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letter dated April 3, 1992.

Compliance Method: Compliance with this emission standard is based on calculations utilizing emission factors from EPA AP-42, Attachment #2, Page E-2 of this permit and compliance with Condition E5-4.

The SO_2 emission rate shall be determined using the following equation:

$$SO_2\ (lb/hr) = \left[\frac{GPM}{HPM} \times \frac{1}{1000} \times 142 \times (S)\right] + \left[0.6 \times \frac{MMCF}{HPMG}\right] \quad \text{where:}$$

GPM = Gallons per month of fuel oil used,
HPM = Hours per month of source operation using fuel oil,
S = Sulfur content of fuel (in weight percent),
MMCF = 10^6 Cubic feet of natural gas used per month, and
HPMG = Hours per month of source operating using natural gas.

MONTHLY LOG for source 16-0010-05 *

Date	Operating Hours While Using Fuel Oil	Date	Operating Hours While Using Fuel Oil
1		16	
2		17	
3		18	
4		19	
5		20	
6		21	
7		22	
8		23	
9		24	
10		25	
11		26	
12		27	
13		28	
14		29	
15		30	
		31	

Mo _____, Yr___ Total Fuel Oil Usage _______ Gallons/Month Operating Hrs. on Fuel Oil/Month _______

Sulfur Content _______ Percent by weight lb/hr SO_2 for Month _______

* Record keeping pursuant to Condition E5-5 is only applicable if the source is operational. The Division shall be notified in writing within 30 days of recommencement of operation and the above record keeping shall commence with the first day of operation.

16-0010-06 ETF Heaters (North Heater) (South Heater) Provide heated air for testing operations

Conditions E6-1 through E6-4 apply to source 16-0010-06.

E6-1. Total heat input to these heaters shall not exceed 670 million Btu per hour. This is the capacity of these heaters as stated in the application dated November 15, 1996. The Technical Secretary may require proof of compliance with this limit.

E6-2. Natural gas shall be the only fuel used for these heaters.

E6-3. Particulate matter emitted from this source shall not exceed 3.4 pounds per hour. This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letter dated April 3,1992.

Compliance Method: Compliance shall be assured by the use of natural gas only, compliance with Condition E6-2.

E6-4. Sulfur dioxide emitted from this source shall not exceed 0.4 pounds per hour. This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letter dated April 3,1992.

Compliance Method: The potential sulfur dioxide emissions from this source are less than 5 tons per year. By annual certification of compliance, the permittee shall be considered to meet the monitoring and related recordkeeping and reporting requirements of TAPCR 1200-3-9-.02(11)(e)1(iii) and 1200-3-10-.04(2)(b)(1), and the compliance requirements of TAPCR 1200-3-9-.02(11)(e)3(i).

16-0010-07 VKF Heaters, Dryer Reactivation Heaters W15(3 MM Btu/hr), W16(6.8 MM Btu/hr), W17(3 MM Btu/hr), W18(4 MM Btu/hr) and Process Heater (175MM Btu/hr) used for heating air for testing operations

Conditions E7-1 through E7-5 apply to source 16-0010-07.

E7-1. Total heat input to these heaters shall not exceed 191.8 million Btu per hour. This is the capacity of these heaters as stated in the application dated November 15, 1996. The Technical Secretary may require proof of compliance with this limit.

E7-2. Natural gas will be the only fuel used at this source.

E7-3. Operating time shall not exceed 1,920 hours per State FY (July-June) for Dryer Reactivation Heaters and 1,300 hours per State FY (July-June) for the Process Heater. This limitation is established pursuant to TAPCR 1200-3-6-.01(7) and the information contained in the agreement letters dated April 2,1991 and April 14, 1992.

Compliance Method: A record of the hours of operation of this source must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. This record must be retained for a period of not less than five years.

E7-4. Particulate matter emitted from this source shall not exceed 0.116 lbs/MM Btu (22.25 pounds per hour maximum).

TAPCR 1200-3-6-.02(2)(a)

Compliance Method: The potential particulate emissions from this source are less than 5 tons per year. By annual certification of compliance, the permittee shall be considered to meet the monitoring and related recordkeeping and reporting requirements of TAPCR 1200-3-9-.02(11)(e)1(iii) and 1200-3-10-.04(2)(b)(1), and the compliance requirements of TAPCR 1200-3-9-.02(11)(e)3(i).

E7-5. Sulfur dioxide emitted from this source shall not exceed 0.2 pounds per hour.

TAPCR 1200-3-14-.01(3)

Compliance Method: The potential sulfur dioxide emissions from this source are less than 5 tons per year. By annual certification of compliance, the permittee shall be considered to meet the monitoring and related recordkeeping and reporting requirements of TAPCR 1200-3-9-.02(11)(e)1(iii) and 1200-3-10-.04(2)(b)(1), and the compliance requirements of TAPCR 1200-3-9-.02(11)(e)3(i).

16-0010-08 Two (2) PWT Air Dryers used for testing operations

Conditions E8-1 through E8-5 apply to source 16-0010-08.

E8-1. Maximum heat input to this source shall not exceed 51 million Btu per hour and 60 million Btu per hour (111 MM Btu/hr total). This is the capacity of this source as stated in the application dated March 12, 1999. The Technical Secretary may require proof of compliance with this limit.

E8-2. Natural gas shall be the only fuel used for this source.

E8-3. Operating time shall not exceed 1560 hours per State FY (July-June) for both dryers combined. This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letter dated April 7, 1998.

Compliance Method: A record of the hours of operation of this source must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. This record must be retained for a period of not less than five years.

E8-4. Particulate matter emitted from this source shall not exceed 2.0 pounds per hour. This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letter dated July 20, 1998.

Compliance Method: The potential particulate emissions from this source are less than 5 tons per year. By annual certification of compliance, the permittee shall be considered to meet the monitoring and related recordkeeping and reporting requirements of TAPCR 1200-3-9-.02(11)(e)1(iii) and 1200-3-10-.04(2)(b)(1), and the compliance requirements of TAPCR 1200-3-9-.02(11)(e)3(i).

E8-5. Sulfur dioxide emitted from this source shall not exceed 1.0 pounds per hour. This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the infomation contained in the agreement letter dated July 20, 1998.

Compliance Method: The potential sulfur dioxide emissions from this source are less than 5 tons per year. By annual certification of compliance, the permittee shall be considered to meet the monitoring and related recordkeeping and reporting requirements of TAPCR 1200-3-9-.02(11)(e)1(iii) and 1200-3-10-.04(2)(b)(1), and the compliance requirements of TAPCR 1200-3-9-.02(11)(e)3(i).

16-0010-14 APTU Test Facility, Vitiated Air Heaters, SUE Burner or Gas Generator for Testing Solid and Liquid Rocket Motors as well as Turbine Engines with wet scrubber control

Conditions E9-1 through E9-8 apply to source 16-0010-14.

E9-1. Input heat capacity shall not exceed 167 million Btu per hour for the Vitiated Air Heaters, the Gas Generator, or the Sudden Expansion heater. Only one heater may be operated at a time. The Technical Secretary may require proof of compliance with this limit.

E9-2. Operating time shall not exceed 1000 hours per State FY (July-June). This limitation is established pursuant to TAPCR 1200-3-7-.01(5) and the information contained in the agreement letter dated September 3, 1999 from the permittee.

Compliance Method: A record of the hours of operation of this source must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. This record must be retained for a period of not less than five years.

E9-3. Isobutane or equivalent grade fuels only shall be used for the heaters.

E9-5. Fuels (for rockets and turbines) shall not contain Beryllium.

E9-6. Each rocket shall not contain more than 150 pounds of solid rocket propellants or 1,700 pounds of liquid rocket propellants. Turbine engine testing shall not exceed 5,520 pounds per hour of hydrocarbon fuel.

E9-7. Particulate matter emitted from this source shall not exceed 21.9 pounds per hour. This limitation is established pursuant to TAPCR 1200-3-7-.01(5) and the information contained in the agreement letter dated November 19, 1999 from the permittee.

TAPCR 1200-3-7-.01(5)

Compliance Method: Compliance with this emission standard is based on calculations utilizing emission factors from EPA AP-42 Table 3.2-2, Attachment #2 of this permit and Aircraft Engine Emission Estimator, Attachment #3 of this permit.

E9-8. Sulfur dioxide emitted from this source shall not exceed 4.0 pounds per hour.

TAPCR 1200-3-7-.07(2)

Compliance Method: The potential sulfur dioxide emissions from this source are less than 5 tons per year. By annual certification of compliance, the permittee shall be considered to meet the monitoring and related recordkeeping and reporting requirements of TAPCR 1200-3-9-.02(11)(e)1(iii) and 1200-3-10-.04(2)(b)(1), and the compliance requirements of TAPCR 1200-3-9-.02(11)(e)3(i).

16-0010-17 Liquid Rocket Testing with wet scrubber controls. This testing may be conducted either in 16-0010-17 Liquid Rocket Test Cell Facility, 16-0010-18 Solid Rocket Test Cell Facility, 16-0010-19 ETF Test Cells, or 16-0010-31 ASTF Test Cells

Condition E10-1 applies to Liquid Rocket Testing.

E10-1. Propellant usage for this testing shall not exceed the following:

Fuel	Usage pounds /yr.
Hydrazine fuels	327,000
Nitrogen Tetroxide (N_2O_4)	585,000

This is the capacity of this source as stated in the application dated November 15, 1996.

Compliance Method: A record of the pounds of hydrazine fuel and tetroxide used for liquid rocket testing must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. This record must be retained for a period of not less than five years.

16-0010-18 Solid Rocket Testing with wet scrubber control. This testing may be conducted either in 16-0010-18 Solid Rocket Test Cell Facility, 16-0010-19 ETF Test Cells, or 16-0010-31 ASTF Test Cells as well as enclosed chambers, such as the J6 dehumidification chamber, within the Solid Rocket Test Complex

Conditions E11-1 through E11-3 apply to Solid Rocket Testing.

E11-1. Propellant burned shall not exceed 120,000 pounds per engine tested. This is equivalent to the capacity of this source as stated in the application dated November 15, 1996 since physically engines can not be tested at a frequency of more than one per hour.

Compliance Method: A record of each solid rocket test and propellant weight used for this testing must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. This record must be retained for a period of not less than five years.

E11-2. Particulate matter emitted from this testing shall not exceed 0.02 gr/dscf (27.2 lbs/hr).

TAPCR 1200-3-7-.01(5)

Compliance Method: Compliance with this emission standard is based on operation of the scrubber during rocket testing and/or calculations utilizing emission factors in Attachment 2.

E11-3. Carbon monoxide (CO) emitted from this testing shall not exceed 23,000 lbs/hr and 168 tons per State FY (July-June).

TAPCR 1200-3-7.01(5)

Compliance Method: Compliance with the hourly emission standard is based on calculations utilizing engineering estimates, Attachment #2, Page E-13 of this permit. Compliance with the yearly emission standard shall be calculated using the same engineering estimates and the logs required by Condition E11-1.

16-0010-19 ETF Test Cells (Including Glycol Reboilers A & B) with wet scrubber and vapor condenser control

Conditions E12-1 through E12-8 apply to source 16-0010-19.

E12-1. Aviation fuel input rate for air-breathing propulsion engine testing shall not exceed 80,000 pounds per hour. This is the capacity of this source as stated in the application dated November 15, 1996.

Compliance Method: A record of the aviation fuel used for this testing must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. This record must be retained for a period of not less than five years.

E12-2. Combined operating time for air-breathing propulsion engine testing using ETF Test Cells, Source 19, and ASTF Test Cells Source 31, shall not exceed 3,600 hours per State FY (July-June). This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letter dated May 26, 1999.

Compliance Method: A record of the hours of this testing must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. This record must be retained for a period of not less than five years.

E12-3. Particulate matter emitted shall not exceed 12.0 lbs/hr during air-breathing propulsion engine testing. Total particulate matter emitted from turbine engine testing using ETF Test Cells, Source 19, and the ASTF Test Cells, Source 31, shall not exceed 5.8 tons per State FY (July - June). This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letters dated April 12, 1995 and May 26, 1999.

Compliance Method: Compliance with this emission standard is based on calculations utilizing emission factors in Attachment 2

E12-4. Sulfur dioxide emitted from air-breathing propulsion engine testing shall not exceed 97.0 lbs/hr during air-breathing propulsion engine testing. Total sulfur dioxide emitted from turbine engine testing using ETF Test Cells, Source 19, and the ASTF Test Cells, Source 31, shall not exceed 51.8 tons per State FY (July - June). This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letters dated April 3, 1992 and May 26, 1999.

Compliance Method: Compliance with the hourly emission standard is based on calculations utilizing emission factors from Aircraft Engine Emission Estimator, Attachment #2, Page E-9 of this permit. Compliance with the annual emission standard shall be calculated utilizing the same engineering estimates and the log required by Condition E12-1.

E12-5. Nitrogen oxides (NOx) emitted from air-breathing propulsion engine testing shall not exceed 483.0 lbs/hr. The total Nitrogen Oxides emitted from this source during all air-breathing propulsion engine testing modes shall not exceed 176.0 tons per State FY (July-June). This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letter dated April 12, 1995.

Compliance Method: Compliance with the hourly emission standard is based on calculations utilizing emission factors from Aircraft Engine Emission Estimator, Attachment #2, Page E-9 of this permit. Compliance with the annual emission standard shall be calculated utilizing the same engineering estimates and the log required by Condition E12-1.

E12-6. CO emitted from air-breathing propulsion engine testing shall not exceed 320.0 lbs/hr. The total Carbon Monoxide emitted from air-breathing propulsion engine testing during all testing modes shall not exceed 83.0 tons per State FY (July-June).

TAPCR 1200-3-7-.07(2)

Compliance Method: Compliance with the hourly emission standard is based on calculations utilizing emission factors from Aircraft Engine Emission Estimator, Attachment #2, Page E-9 of this permit. Compliance with the annual emission standard shall be calculated utilizing the same emission factors and the log required by Condition E12-1.

E12-7. VOC emitted from air-breathing propulsion engine testing, excluding the glycol reboiler emissions, shall not exceed 9.9 lb/hr. The total VOC emitted from air-breathing propulsion engine during all testing modes, excluding the glycol reboiler emissions, shall not exceed 7.0 tons per State FY (July-June).

TAPCR 1200-3-7-.07(2)

Compliance Method: Compliance with the hourly emission standard is based on calculations utilizing emission factors from Aircraft Engine Emission Estimator, Attachment #2, Page E-9 of this permit. Compliance with the annual emission standard shall be calculated utilizing the same emission factors and the log required by Condition E12-1.

E12-8. Whenever test conditions allow, this source shall not operate without its associated control device (wet scrubber).

16-0010-28 HB Heaters 1A & 1B provide heated air for testing operations

Conditions E15-1 through E15-5 apply to source 16-0010-28.

E15-1. Total heat input to this source shall not exceed 108 million Btu per hour. This is the capacity of this source as stated in the application dated November 15, 1996. The Technical Secretary may require proof of compliance with this limit.

E15-2. Natural gas or propane shall be the only fuels used for this source.

E15-3. Operating time shall not exceed 3000 hours per State FY (July-June). This limitation is established pursuant to TAPCR 1200-3-7-.01(5) and the information contained in the agreement letter dated May 5, 1982 from the permittee.

Compliance Method: A record of the hours of operation of this source must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. This record must be retained for a period of not less than five years.

E15-4. Particulate matter emitted from this source shall not exceed 0.15 lbs/MM Btu (16.7 pounds per hour).

TAPCR 1200-3-6-.02(2)

Compliance Method: The potential particulate emissions from this source are less than 5 tons per year. By annual certification of compliance, the permittee shall be considered to meet the monitoring and related recordkeeping and reporting requirements of TAPCR 1200-3-9-.02(11)(e)1(iii) and 1200-3-10-.04(2)(b)(1), and the compliance requirements of TAPCR 1200-3-9-.02(11)(e)3(i).

E15-5. Sulfur dioxide emitted from this source shall not exceed 5 lbs/MM Btu (540 pounds per hour).

TAPCR 1200-3-14-.02(2)(a)

Compliance Method: The potential sulfur dioxide emissions from this source are less than 5 tons per year. By annual certification of compliance, the permittee shall be considered to meet the monitoring and related recordkeeping and reporting requirements of TAPCR 1200-3-9-.02(11)(e)1(iii) and 1200-3-10-.04(2)(b)(1), and the compliance requirements of TAPCR 1200-3-9-.02(11)(e)3(i).

16-0010-30 ASTF Heaters, four (4) air heaters used for aeropropultion testing

Conditions E16-1 through E16-8 apply to source 16-0010-30.

E16-1. Total heat input to this source shall not exceed 2,016 million Btu per hour. This is the capacity of this source as stated in the application dated November 15, 1996. The Technical Secretary may require proof of compliance with this limit.

E16-2. Commingled fuel consisting of various combinations of fuels such as JP fuels, aviation fuels, and/or #2 fuel oil shall be the only fuel used for these heaters.

E16-3. The maximum fuel usage for this source shall not exceed 1,500,000 gallons of jet fuel per State FY (July-June). This limitation is established for fee purposes and to avoid PSD, pursuant to Rule s 1200-3-26-.02(6)(b), 1200-3-7-.01(5), 1200-3-6-.01(7), and 1200-3-14-.01(3) of the Tennessee Air Pollution Control Regulations and the information contained in the agreement letter dated May 10, 1999 from the permittee.

Compliance Method: Compliance with this emission standard is based on the record keeping requirements of Condition E16-8.

E16-4. The sulfur content of the fuel oil shall not exceed 0.3 percent by weight. This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letter dated April 3, 1992.

Compliance Method: Vendor supplied certifications or records of the sulfur content of each batch of fuel. These records must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. These records must be used for annual compliance certification and must be retained for a period of not less than five years.

E16-5. Particulate matter emitted from this source shall not exceed 32.4 pounds per hour. This limitation is established for fee purposes pursuant to Rule s 1200-3-26-.02(6)(b), and 1200-3-7-.01(5) of the Tennessee Air Pollution Control Regulations and the information contained in the agreement letter dated May 10, 1999 from the permittee.

Compliance Method: Compliance with this emission standard is based on calculations utilizing emission factors from EPA AP-42 Table 1.4-1, Attachment #2 of this permit.

E16-6. Sulfur dioxide emitted from this source shall not exceed 690 pounds per hour. This limitation is established for fee purposes pursuant to Rule s 1200-3-26-.02(6)(b), and 1200-3-14-.01(3) of the Tennessee Air Pollution Control Regulations and the information contained in the agreement letter dated May 10, 1999 from the permittee

Compliance Method: Compliance with this emission standard is based on calculations utilizing emission factors from EPA AP-42 Table 1.4-1, Attachment #2 of this permit.

E16-7. Nitrogen oxide emitted from this source shall not exceed 324 pounds per hour. This limitation is established for fee purposes pursuant to Rules 1200-3-26-.02(6)(b), and 1200-3-6-.01(7) of the Tennessee Air Pollution Control Regulations and the information contained in the agreement letter dated May 10, 1999 from the permittee

Compliance Method: Compliance with this emission standard is based on calculations utilizing emission factors from EPA AP-42 Table 1.4-1, Attachment #2 of this permit.

E16-8. A record of the fuel usage must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. This record must be retained for a period of not less than five years.

16-0010-31 ASTF Test Cells And Glycol Reboilers EG-A & EG-B with wet scrubber control

Conditions E17-1 through E17-5 apply to source 16-0010-31.

E17-1. Input capacity for turbine engine testing shall not exceed 80,000 pounds per hour of JP fuels, and 90,000 pounds per hour of Liquid Hydrogen. This is the capacity of this source as stated in the application dated November 15, 1996.

Compliance Method: A record of the fuel used for this testing must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. This record must be retained for a period of not less than five years.

E17-2. Combined operating time for air-breathing propulsion engine testing using ETF Test Cells, Source 19, and ASTF Test Cells Source 31, shall not exceed 3,600 hours per State FY (July-June). This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letter dated May 26, 1999 from the permittee.

Compliance Method: A record of the hours for this testing must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. This record must be retained for a period of not less than five years.

E17-3. Particulate matter emitted from turbine engine testing at this source shall not exceed 12.0 Lbs/hr. Total particulate matter emitted from turbine engine testing using ETF Test Cells, Source 19, and ASTF Test Cells Source 31, shall not exceed 5.8 tons per State FY (July - June). This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letters dated April 3, 1992 and May 26, 1999.

Compliance Method: Compliance with this emission standard is based on calculations specified in Attachment 2..

E17-4. Sulfur dioxide emitted from turbine engine testing at this source shall not exceed 97.0 pounds per hour. Total sulfur dioxide emitted from turbine engine testing using ETF Test Cells, Source 19, and ASTF Test Cells Source 31, shall not exceed 51.8 tons per State FY (July - June). This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letters dated April 3, 1992 and May 26, 1999.

Compliance Method: Compliance with this emission standard is based on calculations utilizing emission factors from Aircraft Engine Emission Estimator, Attachment #2, Page E9 of this permit. Compliance with the annual emission standard shall be calculated utilizing the same emission factors and the log required by Condition E17-1.

E17-5. Whenever test conditions allow, this source shall not operate without its associated control device (wet scrubber).

16-0010-35 VKF Auxiliary Heater

Conditions E18-1 through E18-4 apply to source 16-0010-35.

E18-1. Total heat input to this heater shall not exceed 16 million Btu per hour. This is the capacity of this source as stated in the application dated November 15, 1996. The Technical Secretary may require proof of compliance with this limit.

E18-2. Natural gas shall be the only fuel used for these heaters.

E18-3. Particulate matter emitted from this source shall not exceed 0.5 pounds per hour. This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letter dated April 3, 1992.

Compliance Method: The potential particulate emissions from this source are less than 5 tons per year. By annual certification of compliance, the permittee shall be considered to meet the monitoring and related recordkeeping and reporting requirements of TAPCR 1200-3-9-.02(11)(e)1(iii) and 1200-3-10-.04(2)(b)(1), and the compliance requirements of TAPCR 1200-3-9-.02(11)(e)3(i).

E18-4. Sulfur dioxide emitted from this source shall not exceed 0.5 pounds per hour. This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letter dated April 3, 1992.

Compliance Method: The potential sulfur dioxide emissions from this source are less than 5 tons per year. By annual certification of compliance, the permittee shall be considered to meet the monitoring and related recordkeeping and reporting requirements of TAPCR 1200-3-9-.02(11)(e)1(iii) and 1200-3-10-.04(2)(b)(1), and the compliance requirements of TAPCR 1200-3-9-.02(11)(e)3(i).

16-0010-40 Chemical Cleaning Facility

Conditions E20-1 and E20-2 apply to source 16-0010-40.

E20-1. For fee purposes, records from which can be determined the quantities of volatile organic compounds emitted shall be maintained. These records must be retained for not less than five years.

VOC Log For (16-0010-40) **Month:________**

	Material	Usage (gallons)	Pounds of VOC per Gallon	Pounds of VOC
1				
2				
3				
4				
			Total Pounds of VOC ⇒	

E20-2. A construction permit will be required prior to usage of any halogenated solvents subject to MACT (Maximum Achievable Control Technology) Standards.

16-0010-42 ARC Heaters (3)

Conditions E22-1 through E22-2 apply to source 16-0010-42.

E22-1. Operating time shall not exceed 27 hours per State FY (July-June) for all three (3) heaters combined. This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letter dated September 17, 1996 from the permittee.

Compliance Method: A record of the hours of operation for this source must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. This record must be retained for a period of not less than five years.

E22-2. Nitrogen Oxides (NOx) emitted from this source shall not exceed 20.4 tons per State FY (June - July).

TAPCR 1200-3-7-.01(5) and the agreement letter dated September 17, 1996 from the permittee.

Compliance Method: Compliance with this emission standard is based on Condition E22-1 and a test developed emission factor of 0.42 lb/second NOx generation, Attachment #2, Page E-15 of this permit and record keeping per condition E22-1.

16-0010-43 Steamplant C

Conditions E23-1 through E23-4 apply to source 16-0010-43.

E23-1. Total heat input to this source shall not exceed 50 million Btu per hour. This is the capacity of this source as stated in the application dated November 15, 1996. The Technical Secretary may require proof of compliance with this limit.

E23-2. Natural gas shall be the only fuel used for this source.

E23-3. Particulate matter emitted from this source shall not exceed 0.25 lbs/MM Btu (12.2 pounds per hour maximum).

TAPCR 1200-3-6-.02(2)

Compliance Method: The potential particulate emissions from this source are less than 5 tons per year. By annual certification of compliance, the permittee shall be considered to meet the monitoring and related recordkeeping and reporting requirements of TAPCR 1200-3-9-.02(11)(e)1(iii) and 1200-3-10-.04(2)(b)(1), and the compliance requirements of TAPCR 1200-3-9-.02(11)(e)3(i).

E23-4. Sulfur dioxide emitted from this source shall not exceed 0.03 pounds per hour.

TAPCR 1200-3-6-.03(2)

Compliance Method: The potential sulfur dioxide emissions from this source are less than 5 tons per year. By annual certification of compliance, the permittee shall be considered to meet the monitoring and related recordkeeping and reporting requirements of TAPCR 1200-3-9-.02(11)(e)1(iii) and 1200-3-10-.04(2)(b)(1), and the compliance requirements of TAPCR 1200-3-9-.02(11)(e)3(i).

16-0010-45 Two (2) ASTF Air Strippers

Conditions E24-1 through E24-4 apply to source 16-0010-45.

E24-1. The volatile organic compound (VOC) monthly average concentration shall not exceed 0.01%. This is the capacity of this source as stated in the application dated November 15, 1996.

Compliance Method: Compliance shall be determined base on the record keeping requirements of Condition E24-5.

E24-2. The maximum process rate for this source shall not exceed 30,000 gallons of water per hour for both air strippers (operate in series). This is the capacity of this source as stated in the application dated November 15, 1996.

Compliance Method: Compliance shall be determined base on the record keeping requirements of Condition E24-5.

E24-3. Operating time shall not exceed 5000 hours per all intervals of twelve (12) consecutive months. This limitation is established pursuant to Rule 1200-3-26-.02(6)(b) of the Tennessee Air Pollution Control Regulations and the information contained in the agreement letter dated May 4, 1999 from the permittee.

Compliance Method: Compliance shall be determined base on the record keeping requirements of Condition E24-5.

E24-4. A record of the process rate, operating hours and groundwater VOC concentration must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. This record must be retained for a period of not less than five years.

16-0010-46 T-3 Air Heater

Conditions E25-1 through E25-5 apply to source 16-0010-46.

E25-1. Total heat input to this source shall not exceed 188 million Btu per hour. This is the capacity of this source as stated in the application dated November 15, 1996. The Technical Secretary may require proof of compliance with this limit.

E25-2. Natural gas shall be the only fuel used for this source. This emission limitation is established pursuant to Rule 1200-3-6-.01(7) of the Tennessee Air Pollution Control Regulations and the information contained in the agreement letter dated December 21, 1989 from the permittee to avoid PSD.

E25-3. Operating time shall not exceed four hundred sixteen (416) hours per State FY (July-June). This limitation is established pursuant to Rule 1200-3-6-.01(7) of the Tennessee Air Pollution Control Regulations and the information contained in the agreement letter dated December 21, 1989 from the permittee to avoid PSD.

Compliance Method: A record of the hours of operation for this source must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. This record must be retained for a period of not less than five years.

E25-4. Particulate matter emitted from this source shall not exceed 0.177 lbs/MM Btu (33.3 pounds per hour maximum).

TAPCR 1200-3-6-.01(7)

Compliance Method: The potential particulate emissions from this source are less than 5 tons per year. By annual certification of compliance, the permittee shall be considered to meet the monitoring and related recordkeeping and reporting requirements of TAPCR 1200-3-9-.02(11)(e)1(iii) and 1200-3-10-.04(2)(b)(1), and the compliance requirements of TAPCR 1200-3-9-.02(11)(e)3(i).

E25-5. Sulfur dioxide emitted from this source shall not exceed 0.2 pounds per hour.

TAPCR 1200-3-6-.03(2)

Compliance Method: The potential sulfur dioxide emissions from this source are less than 5 tons per year. By annual certification of compliance, the permittee shall be considered to meet the monitoring and related recordkeeping and reporting requirements of TAPCR 1200-3-9-.02(11)(e)1(iii) and 1200-3-10-.04(2)(b)(1), and the compliance requirements of TAPCR 1200-3-9-.02(11)(e)3(i).

16-0010-52 PWT Engine Testing with wet scrubber control

Conditions E28-1 through E28-6 apply to source 16-0010-52.

E28-1. The fuel input rate shall not exceed the following:

i) Aircraft turbine engines: 80,000 lbs/hour.

ii) Small liquid rocket motors: 30,000 lbs/year.

iii) Small solid rocket motors: 30,300 lbs/year.

This is the capacity of this source as stated in the application dated November 15, 1996.

Compliance Method: A record of the hours of operation for this source, test article fuel type, fuel usage rate (turbine engine), and fuel quantity (rocket) must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. This record must be retained for a period of not less than five years.

E28-2. Operating time shall not exceed 250 hours per State FY (July-June). This limitation is established pursuant to TAPCR 1200-3-6-.01(7) and the information contained in the agreement letters dated April 6,1995 from the permittee.

Compliance Method: Compliance shall be determined based on the record keeping required by condition E28-1.

E28-3. Particulate matter emitted from this source shall not exceed 3.8 Lbs/Hr for turbine engine testing, 6.5 Lbs/Second for solid rocket testing and 1.0 tons per State FY (July-June) for all types of testing. This limitation is established pursuant to TAPCR 1200-3-6-.01(7) and the information contained in the agreement letters dated April 6,1995 from the permittee.

TAPCR 1200-3-6-.01(7)

Compliance Method: : Compliance with this emission standard is based on calculations utilizing emission factors in Attachment 2.

E28-4. Sulfur dioxide emitted from this source during testing of engines shall not exceed 0.6 pounds per hour during idle mode, 12.0 lbs/hr during military mode, and 81 lbs/hr during afterburner mode of the turbine engines being tested and the annual emissions shall not exceed 1.4 tons per State FY (July-June).

TAPCR 1200-3-14-.01(3)

Compliance Method: Records required by Condition E28-1 and hours of operation, test fuel type, fuel usage rate (turbine engines), and emission factors taken from Aircraft Engine Emission Estimator for turbine engines, Attachment #2, Page E-10 of this permit.

E28-5. Hydrogen chloride (HCL) emitted from this source shall not exceed 12.7 lbs/second during boost and 2.4 lbs/second during sustain mode of testing for solid rocket motor testing and the total annual emissions shall not exceed 3.22 tons per State FY (July-June).

TAPCR 1200-3-7-.07(2)

Compliance Method: Hours of operation, propellant usage rate (rocket engines), and emission factor of 0.29 lb. HCL per pound of propellant.

E28-6. This source shall not operate without its associated control device (wet scrubber).

16-0010-53 SL1 Test Cell

Conditions E29-1 through E29-7 apply to source 16-0010-53.

E29-1. Operating time shall not exceed 480 hours per State FY (July-June). This limitation is established pursuant to the information contained in the mutual agreement letter dated May 17, 1993 from the permittee.

Compliance Method: Compliance shall be determined from the record keeping requirement of Condition E29-8.

E29-2. Jet fuel usage rate shall not exceed 1,220,000 gallons per State FY (July-June). This is the capacity of this source as stated in the application dated November 15, 1996. The Technical Secretary may require proof of compliance with this limit.

Compliance Method: Compliance shall be determined from the record keeping requirement of Condition E29-8.

E29-3. Particulate matter emitted from this source shall not exceed 13.5 Lbs/Hr and 0.9 tons per State FY (July-June). This limitation is established pursuant to TAPCR 1200-3-7-.01(5) and the information contained in the agreement letters dated May 17, 1993 from the permittee.

Compliance Method: Compliance with this emission standard is based on calculations utilizing, Aircraft Engine Emission Factors, Attachment #2, Page E-9 of this permit and the records required by Condition E29-8.

E29-4. Sulfur dioxide emitted from this source shall not exceed 109 lbs/hr per hour and 7.6 tons per State FY (July-June). This limitation is established pursuant to TAPCR 1200-3-7-.01(5) and the information contained in the agreement letters dated May 17, 1993 from the permittee.

Compliance Method: Compliance with this emission standard is based on calculations utilizing, Aircraft Engine Emission Factors, Attachment #2, Page E-9 of this permit and the records required by Condition E29-8.

E29-5. Nitrogen oxides (NOx) emitted from this source shall not exceed 544 lbs/hr and 37.9 tons per State FY (July-June). This limitation is established pursuant to TAPCR 1200-3-7-.01(5) and the information contained in the agreement letters dated May 17, 1993 from the permittee.

Compliance Method: Compliance with this emission standard is based on calculations utilizing, Aircraft Engine Emission Factors, Attachment #2, Page E-9 of this permit and the records required by Condition E29-8.

E29-6. Carbon monoxide (CO) emitted from this source shall not exceed 360 lbs/hr and 17.9 tons per State FY (July-June). This limitation is established pursuant to TAPCR 1200-3-7-.01(5) and the information contained in the agreement letters dated May 17, 1993 from the permittee.

Compliance Method: Compliance with this emission standard is based on calculations utilizing, Aircraft Engine Emission Factors, Attachment #2, Page E-9 of this permit and the records required by Condition E29-8.

E29-7. Volatile Organic Compounds (VOC's) emitted from this source shall not exceed 11.2 lbs/hr and 1.6 tons per State FY (July-June). This limitation is established pursuant to TAPCR 1200-3-7-.01(5) and the information contained in the agreement letters dated May 17, 1993 from the permittee.

Compliance Method: Compliance with this emission standard is based on calculations utilizing, Aircraft Engine Emission Factors, Attachment #2, Page E-9 of this permit and the records required by Condition E29-8.

E29-8. A record of the hours of operation and fuel usage rate for this source must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. Record keeping is not required on days when the source is not operating however periods that this source is not operated must be documented. This record must be retained for a period of not less than five years.

16-0010-54 Westinghouse Combustor Test Rig

Conditions E30-1 through E30-6 apply to source 16-0010-54.

E30-1. Maximum heat input rate to this source shall not exceed 116 million Btu per hour. This is the capacity of this source as stated in the application dated November 15, 1996. The Technical Secretary may require proof of compliance with this limit.

E30-2. Operating time shall not exceed 300 hours per year. This limitation is established pursuant to Rule 1200-3-6-.01(7) of the Tennessee Air Pollution Control Regulations and the information contained in the mutual agreement letter dated October 1, 1993 from the permittee.

Compliance Method: A record of the hours of operation must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. This record must be retained for a period of not less than five years.

E30-3. Natural gas, diesel, #2 fuel oil and synthetic fuels which have emission rates below that of natural gas shall be the only fuels used for this source.

E30-4. The sulfur content of the fuel shall not exceed 0.4 percent. This limitation is established pursuant to TAPCR 1200-3-14-.01(3) and the information contained in the application dated May 15, 1997.

Compliance Method: Vendor supplied certifications or records of the sulfur content of each batch of fuel. These records must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. These records must be used for annual compliance certification and must be retained for a period of not less than five years.

E30-5. Particulate matter emitted from this source shall not exceed 0.154 lbs/MM Btu (17.8 pounds per hour maximum).

TAPCR 1200-3-6-.01(7) and 1200-3-6-.02(2)

Compliance Method: Compliance with this emission standard is based on calculations utilizing emission factors from manufacturer, Attachment #2, Page E-16 of this permit and compliance with Condition E30-3.

E30-6. Sulfur dioxide emitted from this source shall not exceed 5 lbs/MM Btu (580 lbs/hr per hour maximum). And 7.2 tons per State FY (July-June).

TAPCR 1200-3-6-.03(2)

Compliance Method: Compliance with this emission standard is based on Conditions E30-1, E30-2 and E30-4 and calculations utilizing emission factors from manufacturer, Attachment #2, Page E-16 of this permit.

16-0010-56 SL2/SL3 Test Cells (Large Engine Test Facility) PSD/BACT

Conditions E32-1 through E32-10 apply to source 16-0010-56.

E32-1. Maximum fuel input rate shall not exceed 90,000 pounds per hour per cell and 180,000 pounds per hour for both cells combined. This is the capacity of this source as stated in the application dated October 14, 1999. The Technical Secretary may require proof of compliance with this limit.

E32-2. Only JP fuel (JP-4, JP-5, & JP-8) shall be used as fuel(s).

E32-3. Particulate matter emitted from this source during all engine testing modes shall not exceed 0.01 grains per dry standard cubic foot of exhaust airflow and 91 tons during all consecutive twelve month periods.

TAPCR 1200-3-9.01(4)

Compliance Method: Compliance with this emission standard is based on calculations utilizing emission factors from Aircraft Engine Emission Estimator, Attachment #2, Page E-11 of this permit along with engineering calculations using pounds per hour rate and airflow from existing engine test data and records required by Condition E32-9.

E32-4. Sulfur dioxide (SO_2) emitted from this source during all engine testing modes shall not exceed 114 tons during all intervals of twelve consecutive months.

TAPCR 1200-3-9.01(4)

Compliance Method: Compliance with this emission standard is based on calculations utilizing emission factors from Aircraft Engine Emission Estimator, Attachment #2, Page E-11 of this permit and records required by Condition E32-9.

E32-5. Nitrogen oxides (NOx) emitted from this source during all engine testing modes shall not exceed 1038 tons during all intervals of twelve consecutive months

TAPCR 1200-3-9-.01(4)

Compliance Method: Compliance with this emission standard is based on calculations utilizing emission factors from Aircraft Engine Emission Estimator, Attachment #2, Page E-11 of this permit and records required by Condition E32-9.

E32-6. Volatile organic compounds (VOC's) emitted from this source during all engine testing modes shall not exceed 325 tons during all intervals of twelve consecutive months

TAPCR 1200-3-9-.01(4)

Compliance Method: Compliance with this emission standard is based on calculations utilizing emission factors from Aircraft Engine Emission Estimator, Attachment #2, Page E-11 of this permit and records required by Condition E32-9.

E32-7. Carbon monoxide (CO) emitted from this source during all engine testing modes shall not exceed 1890 tons during all intervals of twelve consecutive months

TAPCR 1200-3-9-.01(4)

Compliance Method: Compliance with this emission standard is based on calculations utilizing emission factors from Aircraft Engine Emission Estimator, Attachment #2, Page E-11 of this permit and records required by Condition E32-9.

E32-8. The exhaust gases from the SL2/SL3/ test facility shall be discharged unobstructed vertically upwards to the ambient air from a stack with an equivalent exit diameter of 18.71 feet not less than 47 feet above ground level. This condition is established pursuant to Rule 1200-3-9-.01(4) of the Tennessee Air Pollution Control Regulations and the information contained in the final PSD review for this source dated April 8, 1996.

E32-9. A log of the fuel usage rate, operating time, type of fuel used, and type of turbine tested in a form that readily show compliance with conditions E32-1 through E32-7 must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. This record must be retained for a period of not less than five years.

E32-10. The Arnold Engineering Development Center (AEDC) shall continually seek new technology to include, but not be limited to, control for NOx, SO_2, CO, and VOC emissions from aircraft engine test cells when technically and economically acceptable and available to the engine test cell facilities. Status reports shall be submitted to the Technical Secretary addressing each emerging technology, when available.

16-0010-67 Building #878 Air Compressor and test (AC&T) Facility. Air Stripper to remove VOC contaminants.

Conditions E34-1 through E34-4 apply to source 16-0010-67.

E34-1. The process water input rate to the air stripper shall not exceed 12,500 pounds per hour (lb/hr).

Compliance Method: Compliance shall be determined from the records required by Condition E34-4.

E34-2. Volatile Organic Compounds (VOC) emitted from this source shall not exceed 4.5 tons/year. This emission limitation is established pursuant to Rule 1200-3-26-.02(6)(b) of the Tennessee Air Pollution Control Regulations and the information contained in the agreement letter dated March 4, 1999 from the permittee.

Compliance Method: The potential VOC emissions from this source are less than 5 tons per year. By annual certification of compliance, the permittee shall be considered to meet the monitoring and related recordkeeping and reporting requirements of TAPCR 1200-3-9-.02(11)(e)1(iii) and 1200-3-10-.04(2)(b)(1), and the compliance requirements of TAPCR 1200-3-9-.02(11)(e)3(i).

E34-3. Operating time shall not exceed 1200 hours per year. This limitation is established pursuant to Rule 1200-3-26-.02(6)(b) of the Tennessee Air Pollution Control Regulations and the information contained in the agreement letter dated March 4, 1999 from the permittee.

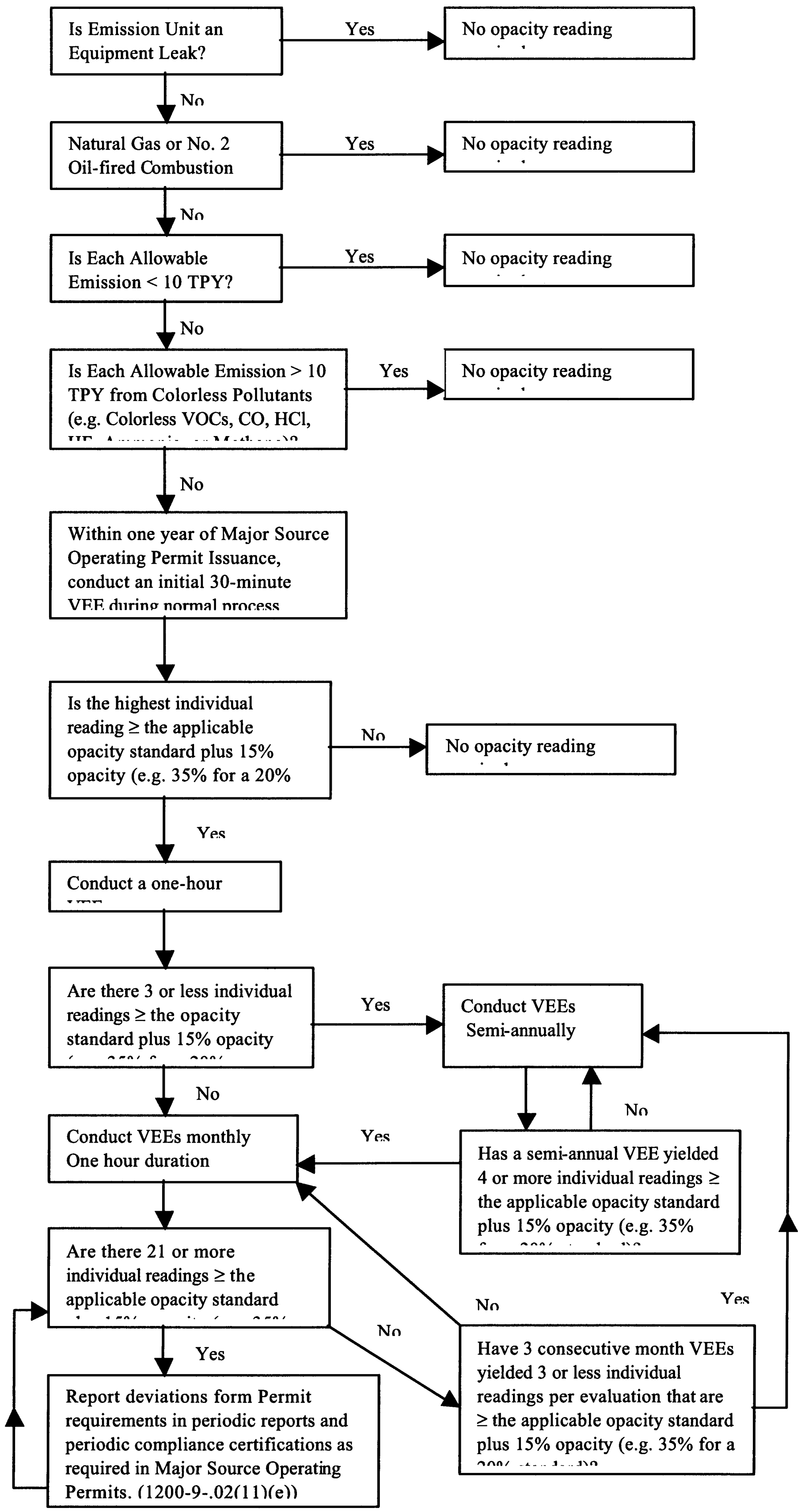
E34-4. A log of the operating hours and process water input rate, in a form that readily shows compliance with conditions E34-1 and E34-3, must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. This log must be retained for a period of not less than five years.

END OF PERMIT NUMBER: 546264

ATTACHMENT 1

OPACITY MATRIX DECISION TREE for VISIBLE EMISSION EVALUATION METHODS 2 & 9 dated JUNE 18, 1996

Decision Tree PMT for Opacity for
<u>Sources Subject to Rule 1200-3-5-.01</u>
<u>Utilizing TVEE Method 2</u>



Notes:

PMT = Periodic Monitoring and Testing required by 1200-3-9-.02(11)(e)(iii).

This Decision Tree outlines the criteria by which major sources can meet the periodic monitoring and testing requirements of Title V for demonstrating compliance with the visible emission standards in paragraph 1200-3-5-.01. It is not intended to determine compliance requirements for EPA's Compliance Assurance Monitoring (CAM) Rule (formerly referred to as Enhanced Monitoring – Proposed 40 CFR 64).

Examine each emission unit using this Decision Tree to determine the PMT required.

Use of continuous emission monitoring systems eliminates the need to do any additional periodic monitoring.

Visible Emission Evaluations (VEEs) are to be conducted utilizing Tennessee Visible Emission Evaluation Method 2. The observer must be properly certified according to the criteria specified in EPA Method 9 to conduct TVEE Method 2 evaluations.

Typical Pollutants
Particulates, VOC, CO, SO_2, NO_x, HCl, HF, HBr, Ammonia, and Methane.

Initial observation to be repeated within 90 days of startup of a modified source, if a new construction permit is issued for modification of the source.

A VEE conducted by TAPCD personnel after the Title V permit is issued will also constitute an initial reading.

Reader Error
TVEE Method 2: The TAPCD declares non-compliance when 21 observations are read at the standard plus 15% opacity (e.g. 35% for a 20% standard).

*The rationale for this is the fact that Rule 1200-3-5-.01 allows for an exemption of 5 minutes (20

Decision Tree PM for Opacity for

Sources Utilizing EPA Method 9

Notes:

PM = Periodic Monitoring required by 1200-3-9-.02(11)(e)(iii).

This Decision Tree outlines the criteria by which major sources can meet the periodic monitoring and testing requirements of Title V for demonstrating compliance with the visible emission standards in paragraph 1200-3-5-.01. It is not intended to determine compliance requirements for EPA's Compliance Assurance Monitoring (CAM) Rule (formerly referred to as Enhanced Monitoring – Proposed 40 CFR 64).

Examine each emission unit using this Decision Tree to determine the PM required.

Use of continuous emission monitoring systems eliminates the need to do any additional periodic monitoring.

Visible Emission Evaluations (VEEs) are to be conducted utilizing EPA Method 9. The observer must be properly certified to conduct valid evaluations.

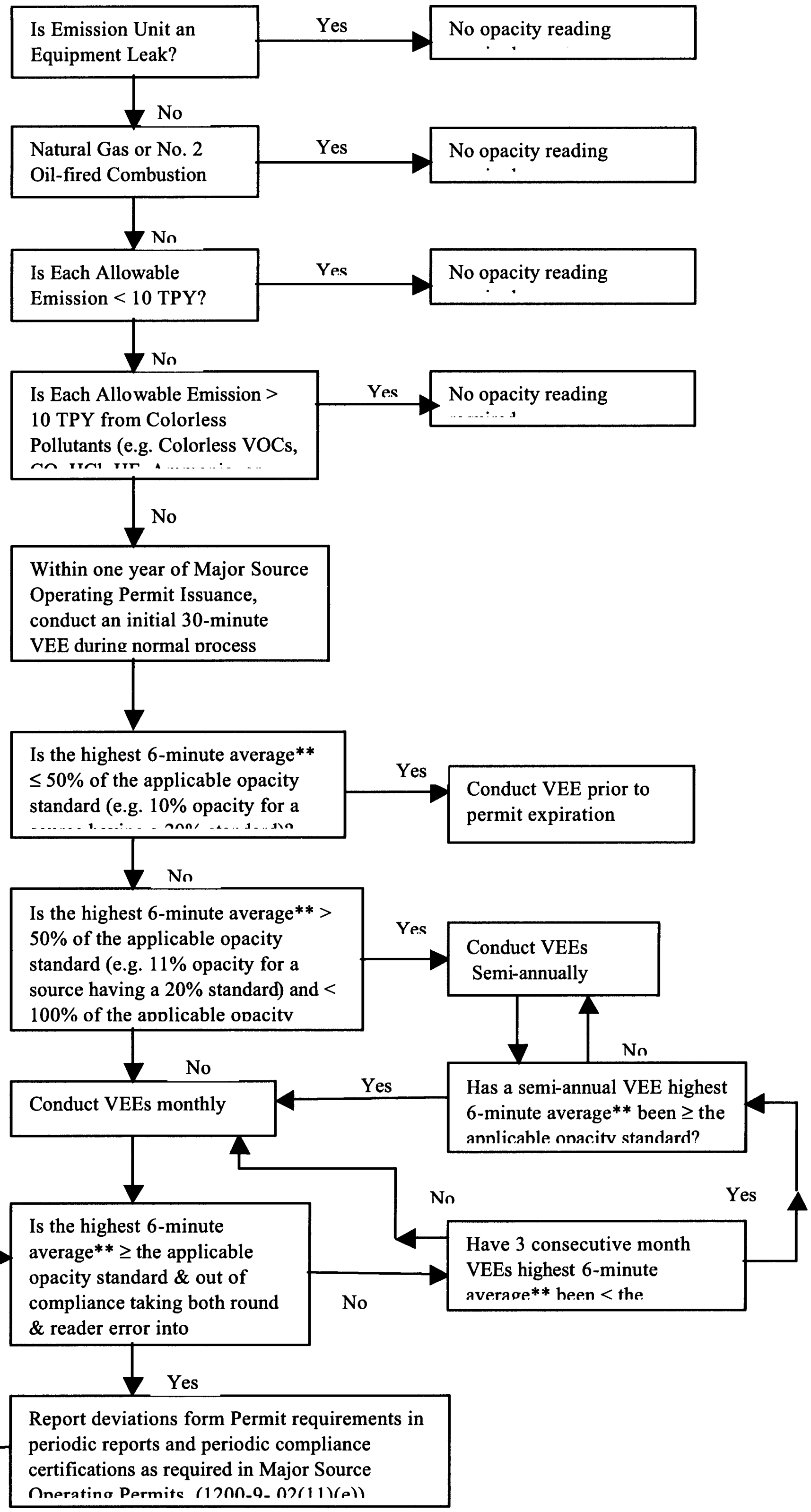
Typical Pollutants
Particulates, VOC, CO, SO_2, NO_x, HCl, HF, HBr, Ammonia, and Methane.

Initial observation to be repeated within 90 days of startup of a modified source, if a new construction permit is issued for modification of the source.

A VEE conducted by TAPCD personnel after the Title V permit is issued will also constitute an initial reading.

Reader Error
EPA Method 9, Non-NSPS or NESHAPS stipulate opacity standards: The TAPCD guidance is to declares non-compliance when the highest six-minute average** exceeds the standard plus 6.8% opacity (e.g. 26.8% for a 20% standard).

EPA Method 9, NSPS or NESHAPS stipulate opacity standards: EPA guidance is to allow only engineering



ATTACHMENT 2

EMISSION FACTORS

Expiration Date: May 8, 2007

EMISSION FACTORS FOR NATURAL GAS COMBUSTION

Boiler Size, MMBTU/hr	Q <0.3	0.3 <=Q<10	10<=Q<100	Q>=100	Units	Reference
CO	40	21	35	40	$lb/10^6 ft^3$	AP-42 5th Ed., Tab 1.4-1, Supp. B
NOx	94	100	140	550	$lb/10^6 ft^3$	AP-42 5th Ed., Tab 1.4-1, Supp. B
TSP	11.17	11.9	14	5	$lb/10^6 ft^3$	AP-42 5th Ed., Tab 1.4-2, Supp. B
SOx	0.6	0.6	0.6	0.6	$lb/10^6 ft^3$	AP-42 5th Ed., Tab 1.4-1, Supp. B
VOC	7.26	3.828	2.784	1.411	$lb/10^6 ft^3$	AP-42 5th Ed., Tab 1.4-3, Supp. B
TOC	11	5.8	5.8	1.7	$lb/10^6 ft^3$	AP-42 5th Ed., Tab 1.4-3, Supp. B
Ammonia	3.2	3.2	3.2	3.2	$lb/10^6 ft^3$	XATEF, SCC 1-01-006-01
CH_4/TOC	0.34	0.34	0.52	0.17	no units	AP-42 5th Ed., Tab 1.4-3, Supp. B
CH_4	3.74	1.972	3.016	0.289	$lb/10^6 ft^3$	AP-42 5th Ed., Tab 1.4-3, Supp. B
Nitrous Oxide	2.2	2.2	2.2	2.2	$lb/10^6 ft^3$	AP-42 5th Ed., Tab 1.4-1, Supp. B
Benzene/TOC	0.04	0.04	0.04	0.04	no units	EPA-450/2-90-001a
Benzene	0.44	0.232	0.232	0.068	$lb/10^6 ft^3$	EPA-450/2-90-001a
Formaldehyde	0.155	0.155	0.155	0.155	$lb/10^6 ft^3$	AP-42 5th Ed., Tab 1.4-4, Supp. B
Hexane/TOC	0.01	0.01	0.01	0.01	no units	EPA-450/2-90-001a
Hexane	0.11	0.058	0.058	0.017	$lb/10^6 ft^3$	EPA-450/2-90-001a
Naphthalene	2.4E-04	2.4E-04	2.4E-04	2.4E-04	$lb/10^6 ft^3$	AP-42 5th Ed., Tab 1.4-4, Supp. B
Toluene	0.0022	0.0022	0.0022	0.0022	$lb/10^6 ft^3$	AP-42 5th Ed., Tab 1.4-4, Supp. B
Arsenic	2.3E-04	2.3E-04	2.3E-04	2.3E-04	$lb/10^6 ft^3$	AP-42 5th Ed., Tab 1.4-5, Supp. B
Chromium	1.1E-03	1.1E-03	1.1E-03	1.1E-03	$lb/10^6 ft^3$	AP-42 5th Ed., Tab 1.4-5, Supp. B
Cobalt	1.2E-04	1.2E-04	1.2E-04	1.2E-04	$lb/10^6 ft^3$	AP-42 5th Ed., Tab 1.4-5, Supp. B
Lead	2.71E-04	2.71E-04	2.71E-04	2.71E-04	$lb/10^6 ft^3$	AP-42 5th Ed., Tab 1.4-5, Supp. B
Manganese	3.81E-04	3.81E-04	3.81E-04	3.81E-04	$lb/10^6 ft^3$	AP-42 5th Ed., Tab 1.4-5, Supp. B
Mercury	0.0012	0.0012	0.0012	0.0012	$lb/10^6 ft^3$	XATEF, Ver 2.0, EPA
Nickel	3.61E-03	3.61E-03	3.61E-03	3.61E-03	$lb/10^6 ft^3$	AP-42 5th Ed., Tab 1.4-5, Supp. B

Note: The heating value for natural gas is assumed to be 1,000 BTU/ft^3 (Perry's Handbook).
Sources using natural gas include: 02,03,04,05,06,07,08,28,35,41,43,46,48,&54.

Permit Number 546264

EMISSION FACTORS FOR PROPANE COMBUSTION

Boiler Size, MMBTU/hr	Q <0.3	0.3 <=Q<10	10<=Q<100	Q>=100	Units	Reference
CO	1.9	1.9	3.2	3.2	lb/1000 gal	AP-42 5th Ed., Tab 1.5-1, Supp. B
NOx	14	14	19	19	lb/1000 gal	AP-42 5th Ed., Tab 1.5-1, Supp. B
TSP	0.4	0.4	0.6	0.6	lb/1000 gal	AP-42 5th Ed., Tab 1.5-1, Supp. B
SOx	0.018	0.018	0.018	0.018	lb/1000 gal	AP-42 5th Ed., Tab 1.5-1, Supp. B
VOC	0.3	0.3	0.3	0.3	lb/1000 gal	AP-42 5th Ed., Tab 1.5-1, Supp. B
TOC	0.5	0.5	0.5	0.5	lb/1000 gal	AP-42 5th Ed., Tab 1.5-1, Supp. B
Methane	0.2	0.2	0.2	0.2	lb/1000 gal	AP-42 5th Ed., Tab 1.5-1, Supp. B
Nitrous Oxide	0.9	0.9	0.9	0.9	lb/1000 gal	AP-42 5th Ed., Tab 1.5-1, Supp. B

Note: The heating value for propane is assumed to be 91,500 BTU/gal (Perry's Handbook)
Sources using propane include 28.

Permit Number 546264

Expiration Date: May 8, 2007

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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO	2.1	2.1	3.6	3.6	lb/1000 gal	AP-42 5th Ed., Tab 1.5-1, Supp. B
NOx	15	15	21	21	lb/1000 gal	AP-42 5th Ed., Tab 1.5-1, Supp. B
TSP	0.5	0.5	0.6	0.6	lb/1000 gal	AP-42 5th Ed., Tab 1.5-1, Supp. B
SOx	0.016	0.016	0.016	0.016	lb/1000 gal	AP-42 5th Ed., Tab 1.5-1, Supp. B
VOC	0.4	0.4	0.4	0.4	lb/1000 gal	AP-42 5th Ed., Tab 1.5-1, Supp. B
TOC	0.6	0.6	0.6	0.6	lb/1000 gal	AP-42 5th Ed., Tab 1.5-1, Supp. B
Methane	0.2	0.2	0.2	0.2	no units	AP-42 5th Ed., Tab 1.5-1, Supp. B
Nitrous Oxide	0.9	0.9	0.9	0.9	lb/1000 gal	AP-42 5th Ed., Tab 1.5-1, Supp. B

Note: The heating lue for isobutane is assumed to be 03,750 BTU/gal Perry' Handbook
Sources sing isobutane includes 14.

Permit Number 546264

EMISSION FACTORS FOR FUEL OIL #2 COMBUSTION

Boiler Size, MMBTU/hr	Q <0.3	0.3 <=Q<10	10<=Q<100	Q>=100	Units	Reference
CO	5	5	5	5	lb/1000 gal	AP-42 5th Ed., Tab 1.3-1, Supp. B
NOx	18	20	20	20	lb/1000 gal	AP-42 5th Ed., Tab 1.3-1, Supp. B
	0.4	2	2	2	lb/1000 gal	AP-42 5th Ed., Tab 1.3-1, Supp. B
SOx	144	144	144	144	lb/1000 gal*%S	AP-42 5th Ed., Tab 1.3-1, Supp. B
	0.713	0.34	0.2	0.76	lb/1000 gal	AP-42 5th Ed., Tab 1.3-1, Supp. B
TOC	2.493	0.556	0.252	1.04	lb/1000 gal	AP-42 5th Ed., Tab 1.3-1, Supp. B
Methane	1.78	0.216	0.052	0.28	lb/1000 gal	AP-42 5th Ed., Tab 1.3-1, Supp. B
Nitrous Oxide	0.05	0.11	0.11	0.11	lb/1000 gal	AP-42 5th Ed., Tab 1.3-7, Supp. B
	2.14E-04	2.14E-04	2.14E-04	2.14E-04	lb/1000 gal	AP-42 5th Ed., Tab 1.3-8, Supp. B
Ethylbenzene	6.36E-05	6.36E-05	6.36E-05	6.36E-05	lb/1000 gal	AP-42 5th Ed., Tab 1.3-8, Supp. B
Formaldehyde	0.061	0.061	0.061	0.061	lb/1000 gal	AP-42 5th Ed., Tab 1.3-7, Supp. B
Hexane/TOC	0.108	0.108	0.108	0.108	no units	EPA-4502\2-90-001a
	0.269244	0.060048	0.027216	0.027216	lb/1000 gal	EPA-4502\2-90-001a
	1.13E-03	1.13E-03	1.13E-03	1.13E-03	lb/1000 gal	AP-42 5th Ed., Tab 1.3-9
Toluene	6.20E-03	6.20E-03	6.20E-03	6.20E-03	lb/1000 gal	AP-42 5th Ed., Tab 1.3-8, Supp. B
1,1,1-Trichloroethane	2.36E-04	2.36E-04	2.36E-04	2.36E-04	lb/1000 gal	AP-42 5th Ed., Tab 1.3-8, Supp. B
o-Xylene	1.09E-04	1.09E-04	1.09E-04	1.09E-04	lb/1000 gal	AP-42 5th Ed., Tab 1.3-8, Supp. B
Antimony	0	0	0	0	lb/1000 gal	AP-42 5th Ed., Tab 1.3-9, Supp. B
Arsenic	0.000588	0.000588	0.000588	0.000588	lb/1000 gal	AP-42 5th Ed., Tab 1.3-9, Supp. B
Beryllium	0.00035	0.00035	0.00035	0.00035	lb/1000 gal	AP-42 5th Ed., Tab 1.3-9, Supp. B
	0.00154	0.00154	0.00154	0.00154	lb/1000 gal	AP-42 5th Ed., Tab 1.3-9, Supp. B
	0.00938	0.00938	0.00938	0.00938	lb/1000 gal	AP-42 5th Ed., Tab 1.3-9, Supp. B
	0	0	0	0	lb/1000 gal	AP-42 5th Ed., Tab 1.3-9, Supp. B
Lead	0.001246	0.001246	0.001246	0.001246	lb/1000 gal	AP-42 5th Ed., Tab 1.3-9, Supp. B
Manganese	0.00196	0.00196	0.00196	0.00196	lb/1000 gal	AP-42 5th Ed., Tab 1.3-9, Supp. B
	0.00042	0.00042	0.00042	0.00042	lb/1000 gal	AP-42 5th Ed., Tab 1.3-9, Supp. B
	0.00252	0.00252	0.00252	0.00252	lb/1000 gal	AP-42 5th Ed., Tab 1.3-9, Supp. B
	0.0033	0.0033	0.0033	0.0033	lb/1000 gal	AP-42 5th Ed., Tab 1.3-7, Supp. B
Selenium	0	0	0	0	lb/1000 gal	AP-42 5th Ed., Tab 1.3-9, Supp. B

The heating value for #2 fuel oil is assumed to be 140,000 BTU/gal (Perry's Handbook). Combustion of similar fuels such as commingled jet fuel are assumed to have the same emission factors.Sources using oil include: 02,03,04,05,30,48,&54

Expiration Date: May 8, 2007

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EMISSION FACTORS FOR J-33-35 TURBINE ENGINE

	Idle	Approach	Intermediate	Military	Units	Reference
CO	127	84.6	49.1	31.3	lb/1000 lb fuel	Aircraft Engine Emissions Estimator, ESL-TR-85-14
NOx	1.5	1.9	2.7	3.6	lb/1000 lb fuel	Aircraft Engine Emissions Estimator, ESL-TR-85-15
SOx	0.30	0.38	0.54	0.72	lb/1000 lb fuel	Aircraft Engine Emissions Estimator, ESL-TR-85-16
TSP	0.73	0.57	0.02	0.02	lb/1000 lb fuel	Aircraft Engine Emissions Estimator, ESL-TR-85-17
VOC	19.5	6.5	1.3	0.5	lb/1000 lb fuel	Aircraft Engine Emissions Estimator, ESL-TR-85-18

Note: Sources using these factors include: 14.

EMISSION FACTORS FOR F100-100 TURBINE ENGINE

[illegible]	Idle	Approach	Intermediate	Military	Afterburner	Reference
CO	24	5.8	1.6	0.9	4	Aircraft Engine Emissions Estimator, ESL-TR-85-14
NOx	3.3	6.7	9.8	27	3.1	Aircraft Engine Emissions Estimator, ESL-TR-85-15
SOx	0.66	1.34	1.96	5.40	0.62	Aircraft Engine Emissions Estimator, ESL-TR-85-16
TSP	0.12	0.27	0.47	0.34	0.15	Aircraft Engine Emissions Estimator, ESL-TR-85-17
VOC	3.2	1.9	0.1	0.1	0.01	Aircraft Engine Emissions Estimator, ESL-TR-85-18

Note: All emission factors are in lb/1000 lb fuel.
Sources using these factors include: 19, 31, & 53.

EMISSION FACTORS FOR F101-100 TURBINE ENGINE

[illegible]	Idle	Military	Afterburner	Units	Reference
CO	120.1	7.6	16.7	lb/1000 lb fuel	Aircraft Engine Emissions Estimator, ESL-TR-85-14
NOx	7.3	2.3	4.6	lb/1000 lb fuel	Aircraft Engine Emissions Estimator, ESL-TR-85-15
SOx	1.2	1.2	1.2	lb/1000 lb fuel	Aircraft Engine Emissions Estimator, ESL-TR-85-16
TSP	0.09	0.02	0.05	lb/1000 lb fuel	Aircraft Engine Emissions Estimator, ESL-TR-85-17
VOC	25.2	0.4	0.1	lb/1000 lb fuel	Aircraft Engine Emissions Estimator, ESL-TR-85-18

Note: Sources using these factors include: 52.

EMISSION FACTORS FOR A PROFILE OF TURBINE ENGINES

		Idle	Approach	Int/Mil	Afterburner	Reference
CO	Large	25.4	10.5	17.5	1289	Eng. Est. based upon combination of engines
CO	Medium	101	13.7	9	843	Eng. Est. based upon combination of engines
CO	Helicopter				3.15	Eng. Est. based upon combination of engines
NOx	Large	7	23	352	255	Eng. Est. based upon combination of engines
NOx	Medium	0.72	16.2	198	241	Eng. Est. based upon combination of engines
NOx	Helicopter				12.1	Eng. Est. based upon combination of engines
SO2	Large	1.1	2.5	10.5	15.5	Eng. Est. based upon combination of engines
SO2	Medium	1.1	2.5	10.5	15.5	Eng. Est. based upon combination of engines
SO2	Helicopter				1.8	Eng. Est. based upon combination of engines
TSP	Large	0.15	8.1	8.1	5.7	Eng. Est. based upon combination of engines
TSP	Medium	10.3	16	23.5	24.1	Eng. Est. based upon combination of engines
TSP	Helicopter				1.78	Eng. Est. based upon combination of engines
TSP	Salt				0.108	Eng. Est. based upon combination of engines
TSP	Sand				23.79558385	Eng. Est. based upon combination of engines
VOC	Large	1.1	1.4	2.6	1213	Eng. Est. based upon combination of engines
VOC	Medium	36.3	1.55	2.6	71.5	Eng. Est. based upon combination of engines
VOC	Helicopter				1.7	Eng. Est. based upon combination of engines

Note: All emission factors are in lb/hr. Factors were determined based upon consideration of several engines of each type expected to be tested.
Sources using these factors include: 56.
The engineering estimate was derived from a cross-section of various engines expected to be evaluated in this facility using various established references such as the "Aircraft Engine Emissions Estimator," ESL-TR-85-14

EMISSION FACTORS FOR HAPs FROM TURBINE ENGINES

	Factor	Units	Reference
Acetaldehyde	0.0483	lb/lb VOC	SPECIATE, Profile 1097
Acrolein	0.0238	lb/lb VOC	SPECIATE, Profile 1097
Benzene	0.0202	lb/lb VOC	SPECIATE, Profile 1097
1,3-Butadiene	0.0189	lb/lb VOC	SPECIATE, Profile 1097
Ethylbenzene	0.0018	lb/lb VOC	SPECIATE, Profile 1097
Formaldehyde	0.1548	lb/lb VOC	SPECIATE, Profile 1097
Naphthalene	0.0060	lb/lb VOC	SPECIATE, Profile 1097
Phenol	0.0026	lb/lb VOC	SPECIATE, Profile 1097
Propionaldehyde	0.0098	lb/lb VOC	SPECIATE, Profile 1097
Styrene	0.0041	lb/lb VOC	SPECIATE, Profile 1097
Toluene	0.0055	lb/lb VOC	SPECIATE, Profile 1097
o-Xylene	0.0020	lb/lb VOC	SPECIATE, Profile 1097
As	0.0053	lb/lb TSP	CARB (1991), Profile 110 for SCCs 2-04-001-01 & -02
Cd	0.0005	lb/lb TSP	CARB (1991), Profile 110 for SCCs 2-04-001-01 & -02
Cr	0.0053	lb/lb TSP	CARB (1991), Profile 110 for SCCs 2-04-001-01 & -02
Pb	0.0055	lb/lb TSP	CARB (1991), Profile 110 for SCCs 2-04-001-01 & -02
Se	0.0005	lb/lb TSP	CARB (1991), Profile 110 for SCCs 2-04-001-01 & -02

Note: All turbine engines are assumed to be speciated according to these factors.
Sources using these factors include: 14, 19, 31, 53, & 56.

EMISSION FACTORS FOR SOLID ROCKET MOTORS

	Factor	Units	Reference
CO	0.1920	lb/lb propellant	Engineering Estimate
TSP	0.29	lb/lb propellant	Engineering Estimate
HCl	0.208	lb/lb propellant	Engineering Estimate
HCN	0.0006	lb/lb propellant	Engineering Estimate

Note: Sources using these factors include: 14 & 18.

EMISSION FACTORS FOR LIQUID ROCKET MOTORS

CO	0.135	lb/lb propellant	Engineering Estimate
CH4	0.012	lb/lb propellant	Engineering Estimate
NH3	0.015	lb/lb propellant	Engineering Estimate

Note: Sources using these factors include: 14 & 17.

EMISSION FACTORS FOR ARC HEATERS

NOx	#42	0.42	lb/sec	Engineering Estimate
NOx	#50	1.00	lb/min	Engineering Estimate

Note: Sources these factors include: 42 & 50.

Emission Factors for the Westinghouse Combustor

Natural Gas				
	average	maximum	Units	Reference
HV	1000	1000	BTU/ft^3	Perry's Handbook
CO	50.8621	143.9655	lb/10^6 ft^3	FAX from Westinghouse (3/21/97)
NOx	142.2414	1086.2069	lb/10^6 ft^3	FAX from Westinghouse (3/21/97)
TSP	3.1034	6.2069	lb/10^6 ft^3	FAX from Westinghouse (3/21/97)
SOx	0.6	0.6	lb/10^6 ft^3	AP-42 5th Ed., Tab 1.4-1, Supp. B
VOC	19.8276	198.2759	lb/10^6 ft^3	FAX from Westinghouse (3/21/97)
Fuel Oil				
	average	maximum	Units	Reference
HV	140000	140000	BTU/gal	Perry's Handbook
CO	8.2069	120.6897	lb/1000 gal	FAX from Westinghouse (3/21/97)
NOx	31.3793	193.1034	lb/1000 gal	FAX from Westinghouse (3/21/97)
TSP	7.7966	15.569	lb/1000 gal	FAX from Westinghouse (3/21/97)
SOx	144	144	%S*lb/1000 gal	AP-42 5th Ed., Tab 1.3-1, Supp. B
VOC	2.7759	27.7586	lb/1000 gal	FAX from Westinghouse (3/21/97)
Dimethyl Ether				
	average	maximum	Units	Reference
HV	12400	12400	BTU/lb	Standard Enthalpy of Formation
CO	0.79103	7.91034	lb/1000 lb	FAX from Westinghouse (3/21/97)
NOx	2.20207	13.46897	lb/1000 lb	FAX from Westinghouse (3/21/97)
TSP	0.03848	0.07697	lb/1000 lb	FAX from Westinghouse (3/21/97)
SOx	0.02672	0.03207	lb/1000 lb	FAX from Westinghouse (3/21/97)
VOC	0.31	3.1	lb/1000 lb	FAX from Westinghouse (3/21/97)

Note: Speciated HAP emissions factors for this source were assumed the same as those for natural gas and fuel oil.

TENNESSEE AIR POLLUTION CONTROL BOARD
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
NASHVILLE, TENNESSEE 37243-1531

MODIFICATION #1 TO
OPERATING PERMIT (TITLE V) **Issued Pursuant to Tennessee Air Quality Act**

This permit fulfills the requirements of Title V of the Federal Clean Air Act (42 U.S.C. 7661a-7661e) and the federal regulations promulgated thereunder at 40 CFR Part 70. (FR Vol. 57, No. 140, Tuesday, July 21, 1992 p.32295-32312). This permit is issued in accordance with the provisions of paragraph 1200-3-9-.02(11) of the Tennessee Air Pollution Control Regulations. The permittee has been granted permission to operate an air contaminant source in accordance with emission limitations, monitoring requirements set forth herein.

Date Issued: May 9, 2002
Date of Minor Modification #1: MAY 2 1 2003
Date Expires: May 8, 2007

Permit Number:
546264

Issued To:
Arnold Engineering Development Center

Installation Address:
100 Kindel Drive
Arnold Air Force Base

Installation Description:
Flight simulation test facilities with aerodynamic and propulsion wind tunnels, rocket and turbine engine test cells, space environments chambers, arc heaters, ballistic ranges and other specialized units. (See next page for details)

Minor Modifications to 16-0010-02, 03, 04, 06, 07, 30, 67: (See next page for details)

Emission Source Reference No.: 16-0010

Renewal Application Due Date:
Between: August 11, 2006 and November 9, 2006

Primary SIC: 97

Responsible Official:
Name: **Larry V. Judge, Captain, USN**
Title: Vice Commander Arnold Engineering Development Center

Facility Contact Person:
Name : **Frank Duncan**
Title: Deputy Chief Environmental Mgt.
Phone: (931) 454-7252

Information Relied Upon:
Minor Modification Applications Dated September 6, 2002

TECHNICAL SECRETARY

No Authority is Granted by this Permit to Operate, Construct, or Maintain any Installation in Violation of any Law, Statute, Code, Ordinance, Rule, or Regulation of the State of Tennessee or any of its Political Subdivisions.

POST OR FILE AT INSTALLATION ADDRESS

CN-0827 (Rev. 9-92)

RDA-1298

Installation Description:

Source Number: Description:

01, 02, 03, 04: Steam Plant A, Boilers 01, 02, 03, 04

Minor Modification #1: Change allowable particulate matter emission rate limits, based on revised AP-42 emission factors, for boilers 02, 03, and 04.

05: Steam Plant B, Boiler 05

06: ETF Heaters (North Heater)(South Heater) Provide heated air for testing operations.

Minor Modification #1: Change allowable particulate matter emission rate limits, based on revised AP-42 emission factors.

07: VKF Heaters (Heater W15) (Heater W16) (Heater W17) (Heater W18) (Process Heater)

Minor Modification #1: Increase input heat capacity, per company request.

08: PWT Air Dryer

14: APTU Test Facility, Vitiated Air Heaters, SUE Burner or Gas Generator, for Testing Solid and Liquid Rocket Motors as well as Turbine Engines.

17: Liquid Rocket Testing. This testing may be conducted either in 16-0010-17 Liquid Rocket Test Cell Facility, 16-0010-18 Solid Rocket Test Cell Facility, 16-0010-19 ETF Test Cells, or 16-0010-31 ASTF Test Cells

18: Solid Rocket Testing. This testing may be conducted either in 16-0010-18 Solid Rocket Test Cell Facility, 16-0010-19 ETF Test Cells, or 16-0010-31 ASTF Test Cells, as well as enclosed chambers, such as the J6 dehumidification chamber, within the Solid Rocket Test Complex.

19: ETF Test Cells (Including Glycol Reboilers A & B)

21: Bulk Fuel Storage Facility

22: Motor Pool/Steamplant Storage Tanks

28: HB1 Heaters 1A & 1B

30: ASTF Heaters

Minor Modification #1: Change allowable particulate matter emission rate limits, based on revised AP-42 emission factors.

31 ASTF Test Cells And Glycol Reboilers EG-A & EG-B

35: VKF Auxiliary Heater

38: I & M Spray Paint Booth

40: Chemical Cleaning Facility

41: Research Heater

42: ARC Heaters (3)

43: Steamplant C

45: ASTF Air Strippers

46: T-3 Air Heater

49: Classified Waste Incinerators

50: ARC Heaters, H3 & H4

52: PWT Engine Testing

53: SL1 Test Cell

54: Westinghouse Combustor Test Rig

55: Test Fuel Storage Facility

56: SL2/SL3 Test Cells

67: AC&T Air Stripper

Minor Modification #1: Increase allowable process water input rate thru construction permit number 951316P.

SOURCE SPECIFIC EMISSION STANDARDS, OPERATING LIMITATIONS, AND MONITORING, RECORDKEEPING AND REPORTING REQUIREMENTS

16-0010	**Facility Description:**	Arnold Engineering Development Center is a complex of flight simulation test facilities with aerodynamic and propulsion wind tunnels, rocket and turbine engine test cells, space environments chambers, arc heaters, ballistic ranges and other specialized units.

16-0010-01, 02, 03, 04	MINOR MODIFICATION TO: Steam Plant A, boilers 01, 02, 03, and 04 used for plant operations **Change allowable particulate matter emission rate limit due to revised AP-42 emission factors for boilers 02, 03, and 04.**

E4-6(M1) Particulate matter emitted from boilers 02, 03, and 04 shall not exceed 5.5 pounds per hour. This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letter dated April 3,1992.

Compliance Method: Compliance with this emission standard is based on calculations utilizing emission factors from EPA AP-42, Tables 1.3-1 and 1.4-2.

M1-1. With the exception of condition E4-6(M1), the permittee shall comply with all the terms and conditions of the Title V permit #546264 for this source.

16-0010-06	MINOR MODIFICATION TO: ETF Heaters (North Heater) (South Heater) Provide heated air for testing operations **Change allowable particulate matter emission rate limit due to revised AP-42 emission factors.**

E6-3(M1). Particulate matter emitted from this source shall not exceed 5.1 pounds per hour. This limitation is established pursuant to TAPCR 1200-3-26-.02(9)(g) and the information contained in the agreement letter dated April 3,1992.

Compliance Method: Compliance shall be assured by the use of natural gas only, compliance with Condition E6-2.

M1-2. With the exception of condition E6-3(M1), the permittee shall comply with all the terms and conditions of the Title V permit #546264 for this source.

16-0010-07	MINOR MODIFICATION TO: VKF Heaters, Dryer Reactivation Heaters W15 (5 MM Btu/hr), W16 (9.8 MMBtu/hr), W17 (5 MM Btu/hr), W18 (9.8 MM Btu/hr) and Process Heater (175MM Btu/hr) used for heating air for testing operations. **Increase allowable input heat capacity to W15, W16, W17, and W18.**

E7-1(M1). Total heat input to these heaters shall not exceed 204.6 million Btu per hour. This is the modified capacity of these heaters as stated in the minor modification letter dated September 6, 2002. The Technical Secretary may require proof of compliance with this limit.

E7-4(M1). Particulate matter emitted from this source shall not exceed 0.116 lbs/MM Btu (23.73 pounds per hour maximum).

TAPCR 1200-3-6-.02(2)(a)

Compliance Method: The potential particulate emissions from this source are less than 5 tons per year. By annual certification of compliance, the permittee shall be considered to meet the monitoring and related recordkeeping and reporting requirements of TAPCR 1200-3-9-.02(11)(e)1(iii) and 1200-3-10-.04(2)(b)(1), and the compliance requirements of TAPCR 1200-3-9-.02(11)(e)3(i).

M1-3 With the exception of conditions E7-1(M1) and E7-4(M1), the permittee shall comply with all the terms and conditions of the Title V permit #546264 for this source.

16-0010-30	MINOR MODIFICATION TO: ASTF Heaters, four (4) air heaters used for aeropropultion testing **Change allowable particulate matter emission rate limit due to revised AP-42 emission factors.**

E16-5(M1). Particulate matter emitted from this source shall not exceed 47.5 pounds per hour. This limitation is established for fee purposes pursuant to Rules 1200-3-26-.02(6)(b), and 1200-3-7-.01(5) of the Tennessee Air Pollution Control Regulations and the information contained in the agreement letter dated May 10, 1999 from the permittee.

Compliance Method: Compliance with this emission standard is based on calculations utilizing emission factors from EPA AP-42, Table 1.4-2.

M1-4 With the exception of condition E16-5(M1), the permittee shall comply with all the terms and conditions of the Title V permit #546264 for this source.

16-0010-67	MINOR MODIFICATION TO: Building #878 Air Compressor and test (AC&T) Facility. Air Stripper to remove VOC contaminants. **Increase allowable process water input rate**

E34-1(M1). The process water input rate to the air stripper shall not exceed 37,500 pounds per hour (lb/hr).

Compliance Method: Compliance shall be determined from the records required by Condition E34-4(M1).

E34-4(M1). A log of the operating hours and process water input rate, in a form that readily shows compliance with conditions E34-1(M1) and E34-3, must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. This log must be retained for a period of not less than five years.

M1-5 With the exception of conditions E34-1(M1) and E34-4(M1), the permittee shall comply with all the terms and conditions of the Title V permit #546264 for this source.

<u>END OF MINOR MODIFICATIONS TO THE TITLE V PERMIT #546264</u>

ADDENDUM NUMBER 1

MINOR MODIFICATION # 1 TO TITLE V PERMIT

Facility Name: Arnold Engineering Development Center (AEDC)
City: Arnold Air Force Base
County: Coffee

Date Applications Received: September 11, 2002
Date Applications Deemed Complete: September 11, 2002

Emission Source Reference No.: 16-0010
Permit No.: 546264

INTRODUCTION

This narrative is being provided to assist the reader in understanding the content of the MINOR MODIFICTION #1 to the Title V operating permit for this facility. The primary purpose of the Title V operating permit is to consolidate and identify existing state and federal air requirements applicable to the above mentioned facility and to provide practical methods for assuring compliance with these requirements.

Acronyms
PSD - Prevention of Significant Deterioration
NESHAP - National Emission Standards for Hazardous Air Pollutants
NSPS - New Source Performance Standards
MACT - Maximum Achievable Control Technology
NSR - New Source Review

I. Identification Information

A. Source Description

List and describe emission source(s):

02,03,04: Steam plant A, boilers used for plant operations
06: ETF Heaters that provide heated air for testing operations.
07: VKF Heaters, Dryer Reactivation Heaters used for heating air for testing operations
30: ASTF Heaters used for aeropropultion testing
67: Air stripper to remove VOC from wastewater

B. Facility Classification

1. Attainment or Non-Attainment Area Location
   Area *is* designated as an attainment area for all criteria pollutants.
2. Company *is* located in a *Class VI area.*

C. Regulatory Status

1. PSD/NSR
   This facility *is* a major source under PSD.

2. MACT Standards
   This facility *is not* a major source for HAPs. This facility *is not* subject to a final MACT Standard.

   List MACT Rule(s) if applicable:

3. Program Applicability
   Are the following programs applicable to the facility?
   PSD *yes*
   NESHAP *no*
   NSPS *no*

II. Minor Modification # 1 (describe the minor mod in terms of emissions and applicable requirements)

AEDC requests that permit limitations for particulate matter emissions be updated based on revised EPA AP-42 emission factors for fuel burning sources. This request applies to sources 02, 03, 04, 06, and 30. Also, AEDC requests a change of water throughput for source 67. This change is accomplished through construction permit number 951316. Finally, AEDC requests that the heat input limits for source 07 be increased to 204.6 MMBTU/hr.

III. Other Requirements

A. Emissions Trading
The facility is not involved in an emission trading program.

B. Acid Rain Requirements
This facility is not subject to any requirements in Title IV of the Clean Air Act.

C. Prevention of Accidental Releases
Not Applicable

IV. Public Participation Procedures

Notification of this draft permit was mailed to the following environmental agencies:

1. EPA Region IV
2. Affected States - Alabama, Georgia

TENNESSEE AIR POLLUTION CONTROL BOARD
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
NASHVILLE, TENNESSEE 37243-1531

MODIFICATION #2 TO

OPERATING PERMIT (TITLE V) Issued Pursuant to Tennessee Air Quality Act

This permit fulfills the requirements of Title V of the Federal Clean Air Act (42 U.S.C. 7661a-7661e) and the federal regulations promulgated thereunder at 40 CFR Part 70. (FR Vol. 57, No. 140, Tuesday, July 21, 1992 p.32295-32312). This permit is issued in accordance with the provisions of paragraph 1200-3-9-.02(11) of the Tennessee Air Pollution Control Regulations. The permittee has been granted permission to operate an air contaminant source in accordance with emission limitations, monitoring requirements set forth herein.

Date Issued: May 9, 2002
Date of Minor Modification #2: [illegible]
Date Expires: May 8, 2007

Permit Number:
546264

Issued To:
Arnold Engineering Development Center

Installation Address:
100 Kindel Drive
Arnold Air Force Base

Installation Description:
Flight simulation test facilities with aerodynamic and propulsion wind tunnels, rocket and turbine engine test cells, space environments chambers, arc heaters, ballistic ranges and other specialized units. (See next page for details)

Minor Modification to 16-0010-56: Increase in stack diameter

Emission Source Reference No.: 16-0010

Renewal Application Due Date:
Between: August 11, 2006 and November 9, 2006

Primary SIC: 97

Responsible Official:
Name: **Larry V. Judge, Captain, USN**
Title: Vice Commander Arnold Engineering Development Center

Facility Contact Person:
Name : **Frank Duncan**
Title: Deputy Chief Environmental Mgt.
Phone: (931) 454-7252

Information Relied Upon:
Minor Modification Application Dated February 28, 2003

TECHNICAL SECRETARY

No Authority is Granted by this Permit to Operate, Construct, or Maintain any Installation in Violation of any Law, Statute, Code, Ordinance, Rule, or Regulation of the State of Tennessee or any of its Political Subdivisions.

POST OR FILE AT INSTALLATION ADDRESS

CN-0827 (Rev. 9-92)

RDA-1298

Installation Description:

Source Number: **Description:**

01, 02, 03, 04: Steam Plant A, Boilers 01, 02, 03, 04
05: Steam Plant B, Boiler 05
06: ETF Heaters (North Heater)(South Heater) Provide heated air for testing operations.
07: VKF Heaters (Heater W15) (Heater W16) (Heater W17) (Heater W18) (Process Heater)
08: PWT Air Dryer
14: APTU Test Facility, Vitiated Air Heaters, SUE Burner or Gas Generator, for Testing Solid and Liquid Rocket Motors as well as Turbine Engines.
17: Liquid Rocket Testing. This testing may be conducted either in 16-0010-17 Liquid Rocket Test Cell Facility, 16-0010-18 Solid Rocket Test Cell Facility, 16-0010-19 ETF Test Cells, or 16-0010-31 ASTF Test Cells
18: Solid Rocket Testing. This testing may be conducted either in 16-0010-18 Solid Rocket Test Cell Facility, 16-0010-19 ETF Test Cells, or 16-0010-31 ASTF Test Cells, as well as enclosed chambers, such as the J6 dehumidification chamber, within the Solid Rocket Test Complex.
19: ETF Test Cells (Including Glycol Reboilers A & B)
21: Bulk Fuel Storage Facility
22: Motor Pool/Steamplant Storage Tanks
28: HB1 Heaters 1A & 1B
30: ASTF Heaters
31 ASTF Test Cells And Glycol Reboilers EG-A & EG-B
35: VKF Auxiliary Heater
38: I & M Spray Paint Booth
40: Chemical Cleaning Facility
41: Research Heater
42: ARC Heaters (3)
43: Steamplant C
45: ASTF Air Strippers
46: T-3 Air Heater
49: Classified Waste Incinerators
50: ARC Heaters, H3 & H4
52: PWT Engine Testing
53: SL1 Test Cell
54: Westinghouse Combustor Test Rig
55: Test Fuel Storage Facility
56: SL2/SL3 Test Cells
Minor Modification #2: Increase in stack diameter
67: AC&T Air Stripper

SOURCE SPECIFIC EMISSION STANDARDS, OPERATING LIMITATIONS, AND MONITORING, RECORDKEEPING AND REPORTING REQUIREMENTS

16-0010	**Facility Description:**	Arnold Engineering Development Center is a complex of flight simulation test facilities with aerodynamic and propulsion wind tunnels, rocket and turbine engine test cells, space environments chambers, arc heaters, ballistic ranges and other specialized units.

16-0010-56	MINOR MODIFICATION TO: SL2/SL3 Test Cells (Large Engine Test Facility) PSD/BACT **Stack diameter is increased.**

E32-8(M2) The exhaust gases from the SL2/SL3 test facility shall be discharged unobstructed vertically upwards to the ambient air from a stack with an equivalent exit diameter not more than 29.85 feet (not more than 700 square feet cross section) and not less than 47 feet above ground level. This condition is established pursuant to Rule 1200-3-9-.01(4) of the Tennessee Air Pollution Control Regulations and the information contained in the PSD dispersion modeling results for the source dated August 1, 2002.

M2-1. With the exception of condition E32-8(M2), the permittee shall comply with all the terms and conditions of the Title V permit #546264 for this source.

END OF MINOR MODIFICATION #2 TO THE TITLE V PERMIT #546264

ADDENDUM NUMBER 1

MINOR MODIFICATION # 2 TO TITLE V PERMIT

Facility Name: Arnold Engineering Development Center (AEDC)
City: Arnold Air Force Base
County: Coffee

Date Applications Received: February 28, 2003
Date Applications Deemed Complete: February 28, 2003

Emission Source Reference No.: 16-0010
Permit No.: 546264

INTRODUCTION

This narrative is being provided to assist the reader in understanding the content of the MINOR MODIFICTION #2 to the Title V operating permit for this facility. The primary purpose of the Title V operating permit is to consolidate and identify existing state and federal air requirements applicable to the above mentioned facility and to provide practical methods for assuring compliance with these requirements.

Acronyms

PSD - Prevention of Significant Deterioration
NESHAP - National Emission Standards for Hazardous Air Pollutants
NSPS - New Source Performance Standards
MACT - Maximum Achievable Control Technology
NSR - New Source Review

I. Identification Information

A. Source Description
List and describe emission source(s):

56: SL2/SL3 Large engine test facility

B. Facility Classification

1. Attainment or Non-Attainment Area Location
   Area *is* designated as an attainment area for all criteria pollutants.
2. Company *is* located in a *Class VI area*.

C. Regulatory Status

1. PSD/NSR
   This facility *is* a major source under PSD.

2. MACT Standards
   This facility *is not* a major source for HAPs. This facility *is not* subject to a final MACT Standard.

   List MACT Rule(s) if applicable:

3. Program Applicability
   Are the following programs applicable to the facility?
   PSD *yes*
   NESHAP *no*
   NSPS *no*

II. Minor Modification # 2 (describe the minor mod in terms of emissions and applicable requirements)

AEDC requests a change in stack configuration to source 56 for operational purposes. Specifically, the stack diameter will be increased to address this problem. Source 56 is a Prevention of Significant Deterioration source at the facility. After reviewing dispersion modeling predictions of pollutant concentrations with respect to this change, it is determined that ambient air quality levels will not be significantly affected. Therefore, permission is granted to effect the change in stack configuration.

III. Other Requirements

A. Emissions Trading
The facility is not involved in an emission trading program.

B. Acid Rain Requirements
This facility is not subject to any requirements in Title IV of the Clean Air Act.

C. Prevention of Accidental Releases
Not Applicable

IV. Public Participation Procedures

Notification of this draft permit was mailed to the following environmental agencies:

1. EPA Region IV
2. Affected States - Alabama, Georgia

TENNESSEE AIR POLLUTION CONTROL BOARD
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
NASHVILLE, TENNESSEE 37243-1531

ADMINSITRATIVE AMENDMENT #1 TO:

OPERATING PERMIT (TITLE V) Issued Pursuant to Tennessee Air Quality Act

This permit fulfills the requirements of Title V of the Federal Clean Air Act (42 U.S.C. 7661a-7661e) and the federal regulations promulgated thereunder at 40 CFR Part 70. (FR Vol. 57, No. 140, Tuesday, July 21, 1992 p.32295-32312). This permit is issued in accordance with the provisions of paragraph 1200-3-9-.02(11) of the Tennessee Air Pollution Control Regulations. The permittee has been granted permission to operate an air contaminant source in accordance with emissions limitations and monitoring requirements set forth herein.

Date Issued: **May 9, 2002**
Date Amended: August 12, 2003
Date Expires: **May 8, 2007**

Permit Number:
546264

Issued To:
Arnold Engineering Development Center

Installation Address:
100 Kindel Drive
Arnold Air Force Base

Installation Description:
Flight simulation test facilities with aerodynamic and propulsion wind tunnels, rocket and turbine engine test cells, space environments chambers, arc heaters, ballistic ranges and other specialized units. (See next page for details)

Emission Source Reference No.: **16-0010**
Renewal Application Due Date: **Between: August 11, 2006 and November 9, 2006**

Primary SIC: **97**

Responsible Official:
Name: **Larry V. Judge, Captain, USN**
Title: Vice Commander Arnold Engineering Development Center

Facility Contact Person:
Name: **Frank Duncan**
Title: Deputy Chief Environmental Mgt.
Phone: (931) 454-7252

Information Relied Upon:
Application dated November 15, 1996 and
Revisions dated January 23, 1997; August 4, 1997; May 29, 1998; June 22, 1999; August 20, 1999; May 30, 2000 and June 1, 2000 and
Letter dated July 16, 2003

(Continued on the next page)

TECHNICAL SECRETARY

No Authority is Granted by this Permit to Operate, Construct, or Maintain any Installation in Violation of any Law, Statute, Code, Ordinance, Rule, or Regulation of the State of Tennessee or any of its Political Subdivisions.

POST OR FILE AT INSTALLATION ADDRESS

CN-0827 (Rev.9-92)

RDA-1298

Installation Description:

Source Number: **Description:**

01, 02, 03, 04: Steam Plant A, Boilers 01, 02, 03, 04
05: Steam Plant B, Boiler 05
06: ETF Heaters (North Heater)(South Heater) Provide heated air for testing operations.
07: VKF Heaters (Heater W15) (Heater W16) (Heater W17) (Heater W18) (Process Heater)
08: PWT Air Dryer
14: APTU Test Facility, Vitiated Air Heaters, SUE Burner or Gas Generator, for Testing Solid and Liquid Rocket Motors as well as Turbine Engines.
17: Liquid Rocket Testing. This testing may be conducted either in 16-0010-17 Liquid Rocket Test Cell Facility, 16-0010-18 Solid Rocket Test Cell Facility, 16-0010-19 ETF Test Cells, or 16-0010-31 ASTF Test Cells
18: Solid Rocket Testing. This testing may be conducted either in 16-0010-18 Solid Rocket Test Cell Facility, 16-0010-19 ETF Test Cells, or 16-0010-31 ASTF Test Cells, as well as enclosed chambers, such as the J6 dehumidification chamber, within the Solid Rocket Test Complex.
19: ETF Test Cells (Including Glycol Reboilers A & B)
21: Bulk Fuel Storage Facility
22: Motor Pool/Steamplant Storage Tanks
28: HB1 Heaters 1A & 1B
30: ASTF Heaters
31 ASTF Test Cells And Glycol Reboilers EG-A & EG-B
35: VKF Auxiliary Heater
38: I & M Spray Paint Booth
40: Chemical Cleaning Facility
41: Research Heater
42: ARC Heaters (3)
43: Steamplant C
45: ASTF Air Strippers
46: T-3 Air Heater
49: Classified Waste Incinerators
50: ARC Heaters, H3 & H4
52: PWT Engine Testing
53: SL1 Test Cell
54: Westinghouse Combustor Test Rig
55: Test Fuel Storage Facility
56: SL2/SL3 Test Cells
67: AC&T Air Stripper

E2. <u>Reporting requirements</u>.

(a) <u>Semiannual reports</u> The first report shall cover the 6-month period from July 1, 2002 to December 31, 2002 and shall be submitted within 60 days after the 6-month period which is March 1, 2003 Subsequent reports shall be submitted within 60 days after the end of each 6-month period following the first report.

These semiannual reports shall include:

(1) Any monitoring and recordkeeping required by Conditions E4-10 and E5-5 of this permit. However, a summary report of this data is acceptable provided there is sufficient information to enable the Technical Secretary to evaluate compliance.

(2) The visible emission evaluation readings from Conditions E3-1 and E3-2 of this permit if required. However, a summary report of this data is acceptable provided there is sufficient information to enable the Technical Secretary to evaluate compliance.

(3) Identification of all instances of deviations from <u>ALL PERMIT REQUIREMENTS</u>.

These reports must be certified by a responsible official consistent with condition B4 of this permit and shall be submitted to The Technical Secretary at the address in Condition E2(b) of this permit.

TAPCR 1200-3-9-.02(11)(e)1.(iii)

(b) <u>Annual compliance certification</u> The permittee shall submit annually compliance certifications with terms and conditions contained in Sections A.B. D and E of this permit, including emission limitations, standards, or work practices. This compliance certification shall include all of the following (provided that the identification of applicable information may cross-reference the permit or previous reports, as applicable):

(1) The identification of each term or condition of the permit that is the basis of the certification;

(2) The identification of the method(s) or other means used by the owner or operator for determining the compliance status with each term and condition during the certification period;

(3) Whether such method(s) or other means provide continuous or intermittent data. Such methods and other means shall include, at a minimum, the methods and means required by this permit. If necessary, the owner or operator also shall identify any other material information that must be included in the certification to comply with section 113(c)(2) of the Federal Act, which prohibits knowingly making a false certification or omitting material information;

(4) The status of compliance with the terms and conditions of the permit for the period covered by the certification, based on the method or means designated in E2(b)2 above. The certification shall identify each deviation and take it into account in the compliance certification. The certification shall also identify as possible exceptions to compliance any periods during which compliance is required and in which an excursion* or exceedance** as defined below occurred; and

(5) Such other facts as the Technical Secretary may require to determine the compliance status of the source.

* "Excursion" shall mean a departure from an indicator range established for monitoring under this paragraph, consistent with any averaging period specified for averaging the results of the monitoring.

** "Exceedance" shall mean a condition that is detected by monitoring that provides data in terms of an emission limitation or standard and that indicates that emissions (or opacity) are greater than the applicable emission limitation or standard (or less than the applicable standard in the case of a percent reduction requirement) consistent with any averaging period specified for averaging the results of the monitoring.

The first certification shall cover the 12-month period from July 1, 2002 to June 30, 2003 and shall be submitted within 60 days after the end of the 12-month period, August 29, 2003. Subsequent certifications shall be submitted within 60 days after the end of each 12-month period following the first certification.

These certifications shall be submitted to:

The Technical Secretary
Division of Air Pollution Control
ATTN: Operating Permits Program
9th Floor, L & C Annex
401 Church Street
Nashville, Tennessee 37243-1531

and

Air and EPCRA Enforcement Branch
US EPA Region IV
61 Forsyth Street, SW
Atlanta, Georgia 30303

40 CFR Part 70.6(c)(5)(iii) as amended in the Federal Register Vol.62, No.204, October 22, 1997, pages 54946 and 54947

16-0010-17	Liquid Rocket Testing with wet scrubber controls. This testing may be conducted either in 16-0010-17 Liquid Rocket Test Cell Facility, 16-0010-18 Solid Rocket Test Cell Facility, 16-0010-19 ETF Test Cells, or 16-0010-31 ASTF Test Cells

Condition E10-1 applies to Liquid Rocket Testing.

E10-1. Propellant usage for this testing shall not exceed the following:

Fuel	Usage [pounds / State FY (July-June)]
Hydrazine fuels	327,000
Nitrogen Tetroxide (N_2O_4)	585,000

This is the capacity of this source as stated in the application dated November 15, 1996.

Compliance Method: A record of the pounds of hydrazine fuel and tetroxide used for liquid rocket testing must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. This record must be retained for a period of not less than five years.

16-0010-52	PWT Engine Testing with wet scrubber control

Conditions E28-1 through E28-6 apply to source 16-0010-52.

E28-1. The fuel input rate shall not exceed the following:

i) Aircraft turbine engines: 80,000 lbs/hour.

ii) Small liquid rocket motors: 30,000 lbs / State FY (July-June).

iii) Small solid rocket motors: 30,300 lbs / State FY (July-June).

This is the capacity of this source as stated in the application dated November 15, 1996.

Compliance Method: A record of the hours of operation for this source, test article fuel type, fuel usage rate (turbine engine), and fuel quantity (rocket) must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. This record must be retained for a period of not less than five years.

16-0010-54	Westinghouse Combustor Test Rig

Conditions E30-1 through E30-6 apply to source 16-0010-54.

E30-2. Operating time shall not exceed 300 hours per State FY (July-June). This limitation is established pursuant to Rule 1200-3-6-.01(7) of the Tennessee Air Pollution Control Regulations and the information contained in the mutual agreement letter dated October 1, 1993 from the permittee.

Compliance Method: A record of the hours of operation must be maintained at the source location and kept available for inspection by the Technical Secretary or his representative. This record must be retained for a period of not less than five years.

16-0010-67	Building #878 Air Compressor and test (AC&T) Facility. Air Stripper to remove VOC contaminants.

Conditions E34-1 through E34-4 apply to source 16-0010-67.

E34-2. Volatile Organic Compounds (VOC) emitted from this source shall not exceed 4.5 tons / State FY (July-June). This emission limitation is established pursuant to Rule 1200-3-26-.02(6)(b) of the Tennessee Air Pollution Control Regulations and the information contained in the agreement letter dated March 4, 1999 from the permittee.

Compliance Method: The potential VOC emissions from this source are less than 5 tons per year. By annual certification of compliance, the permittee shall be considered to meet the monitoring and related recordkeeping and reporting requirements of TAPCR 1200-3-9-.02(11)(e)1(iii) and 1200-3-10-.04(2)(b)(1), and the compliance requirements of TAPCR 1200-3-9-.02(11)(e)3(i).

E34-3. Operating time shall not exceed 1200 hours per State FY (July-June). This limitation is established pursuant to Rule 1200-3-26-.02(6)(b) of the Tennessee Air Pollution Control Regulations and the information contained in the agreement letter dated March 4, 1999 from the permittee.

END OF ADMINISTRATIVE AMENDMENT #1

Amended
August 12, 2003: Removed conditions E19-2 and E20-1 from the reporting requirements listed in condition E2(a)(1). Changed language in conditions E10-1, E28-1, E30-2, E34-2, and E34-3 to read '… / State FY (July-June)' instead of '… / year'.

APPENDIX F

Air Emissions
CY 2000 - 2004

Table F-1 Air Emissions CY 2000 - 2004 (TPY)							
Description	Steam Plant A, #1	Steam Plant A, #1	Steam Plant A, #1	Steam Plant A, #1	Steam Plant A, #1	Steam Plant A, #1	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	4.251783	5.462478	4.0964715	6.0920705	5.106172	4.0964715	6.0920705
NOx	5.65152	6.50295	4.8836	7.2761	6.18787	4.8836	7.2761
PM	0.5042595	0.4942242	0.37202135	0.55597845	0.4841016	0.3720214	0.55597845
SOx	0.3312054	0.0390177	0.0320511	0.052717064	0.078467191	0.0320511	0.3312054
VOC	0.2730417	0.35766225	0.26815925	0.39867125	0.33334345	0.2681593	0.39867125
VOC HAP	0.0945516	0.122327643	0.091729362	0.136400255	0.114225747	0.0917294	0.13640025
TSP HAP	0.000719	0.000395106	0.000301078	0.000457131	0.000445428	0.0003011	0.00071898
CH4	0.1128526	0.14956785	0.1121239	0.16666384	0.139152482	0.1121239	0.16666384
CO2	6710.4393	7803.54	5859.49125	8728.45975	7412.2418	5859.4913	8728.45975
NH3	0.1539744	0.2080944	0.1559632	0.2317584	0.1930416	0.1539744	0.2317584
N2O	0.1104764	0.1430649	0.107278325	0.159518975	0.13357036	0.1072783	0.15951898
R-113	0	0	0	0	0	0	0
Acetaldehyde					0	0	0
Acrolein					0	0	0
Benzene	0.00011	0.000136562	0.000102455	0.000152452	0.000128345	0.0001025	0.00015245
1,3-Butadiene					0	0	0
2-Butanone					0	0	0
Chloroform					0	0	0
Chloromethane					0	0	0
1,1-Dichloroethene					0	0	0
Ethylbenzene	2.671E-06	0	3.1005E-08	1.07007E-07	4.93918E-07	0	2.6706E-06
Ethylene Glycol					0	0	0
Formaldehyde	0.0061702	0.004877213	0.003685125	0.00553447	0.004998139	0.0036851	0.00617023
Hexane	0.0877534	0.1170531	0.087742568	0.130409891	0.108797259	0.0877426	0.13040989
Methylene Chloride	0	0	0	0	0	0	0
Naphthalene	7.68E-05	3.9668E-05	3.02814E-05	4.60802E-05	4.55741E-05	3.028E-05	7.6801E-05
Phenol	0	0	0	0	0	0	0
Propionaldehyde	0	0	0	0	0	0	0
Styrene	0	0	0	0	0	0	0
Tetrachloroethylene	0	0	0	0	0	0	0
Toluene	0.0004239	0.0002211	0.000168733	0.000256675	0.000253256	0.0001687	0.00042394
1,1,1 Trichloroethane	9.91E-06	0	1.1505E-07	3.9707E-07	1.83278E-06	0	9.9099E-06
Trichloroethylene	0	0	0	0	0	0	0
Vinyl Chloride	0	0	0	0	0	0	0
o-Xylene	4.577E-06	0	5.31375E-08	1.83393E-07	8.46494E-07	0	4.577E-06
As	3.314E-05	1.30059E-05	1.00207E-05	1.54271E-05	1.64141E-05	1.002E-05	3.3138E-05
Be	1.764E-05	0	2.0475E-07	7.0665E-07	3.26172E-06	0	1.7636E-05
Cd	7.056E-05	7.15325E-05	5.38171E-05	8.03736E-05	6.96198E-05	5.382E-05	8.0374E-05
Co	4.042E-06	5.46248E-06	4.09403E-06	6.08366E-06	5.06734E-06	4.042E-06	6.0837E-06
Cr	8.5E-05	9.10413E-05	6.84387E-05	0.000102101	8.77174E-05	6.844E-05	0.0001021
Hg	3.015E-05	1.69077E-05	1.28768E-05	1.9537E-05	1.89464E-05	1.288E-05	3.0147E-05
Mn	5.356E-05	2.47112E-05	1.89301E-05	2.89346E-05	2.94471E-05	1.893E-05	5.3557E-05
Ni	0.0001187	0.000136562	0.000102556	0.000152798	0.000129945	0.0001026	0.0001528
Pb	7.697E-05	3.25148E-05	2.49835E-05	3.83322E-05	3.99479E-05	2.498E-05	7.6967E-05
POM	0.0001411	3.36853E-06	4.1334E-06	9.30384E-06	2.87527E-05	3.369E-06	0.00014106
Se	8.818E-05	0	1.02375E-06	3.53325E-06	1.63086E-05	0	8.8181E-05
Total HAPs	0.0952706	0.122722749	0.09203044	0.136857386	0.114671175	0.0920304	0.13685739

Table F-1: (continued)							
Description	Steam Plant A, #2	Steam Plant A, #2	Steam Plant A, #2	Steam Plant A, #2	Steam Plant A, #2	Steam Plant A, #2	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	4.801341	8.6128475	6.2846265	7.114617	8.3089045	4.80134	8.61285
NOx	6.26513	10.51509	7.49314	8.60426	10.01546	6.26513	10.51509
PM	0.5457461	0.8323074	0.5709285	0.6709637	0.77687545	0.54575	0.83231
SOx	0.3144117	0.1681609	0.0495526	0.103177314	0.107046046	0.04955	0.31441
VOC	0.3093931	0.5615634	0.4113897	0.4646186	0.54291185	0.30939	0.56156
VOC HAP	0.1069042	0.1925832	0.1407261	0.159174644	0.185931609	0.10690	0.19258
TSP HAP	0.0007304	0.0008055	0.0004626	0.000608407	0.000687417	0.00046	0.00081
CH4	0.1281456	0.2342462	0.1720099	0.193992196	0.226756816	0.12815	0.23425
CO2	5563.7877	2650.9779	115.90335	1362.2379	1255.15715	115.90335	5563.78770
NH3	0.1754608	0.32456	0.2392592	0.2692096	0.3148496	0.17546	0.32456
N2O	0.1249302	0.2251842	0.1645803	0.18613463	0.217429355	0.12493	0.22518
R-113	0	0	0	0	0	0.00000	0.00000
Acetaldehyde					0	0.00000	0.00000
Acrolein					0	0.00000	0.00000
Benzene	0.0001235	0.000217	0.0001572	0.000178717	0.000208508	0.00012	0.00022
1,3-Butadiene					0	0.00000	0.00000
2-Butanone					0	0.00000	0.00000
Chloroform					0	0.00000	0.00000
Chloromethane					0	0.00000	0.00000
1,1-Dichloroethene					0	0.00000	0.00000
Ethylbenzene	2.487E-06	1.185E-06	5.18E-08	6.08843E-07	5.60984E-07	0.00000	0.00000
Ethylene Glycol					0	0.00000	0.00000
Formaldehyde	0.0064974	0.0087433	0.0056573	0.006893553	0.007917338	0.00566	0.00874
Hexane	0.0997608	0.183072	0.1346055	0.151690939	0.177342959	0.09976	0.18307
Methylene Chloride	0	0	0	0	0	0.00000	0.00000
Naphthalene	7.763E-05	8.292E-05	4.653E-05	6.21356E-05	6.99854E-05	0.00005	0.00008
Phenol	0	0	0	0	0	0.00000	0.00000
Propionaldehyde	0	0	0	0	0	0.00000	0.00000
Styrene	0	0	0	0	0	0.00000	0.00000
Tetrachloroethylene	0	0	0	0	0	0.00000	0.00000
Toluene	0.0004288	0.0004603	0.0002593	0.000345388	0.000389215	0.00026	0.00046
1,1,1 Trichloroethane	9.227E-06	4.397E-06	1.922E-07	2.25923E-06	2.08164E-06	0.00000	0.00001
Trichloroethylene	0	0	0	0	0	0.00000	0.00000
Vinyl Chloride	0	0	0	0	0	0.00000	0.00000
o-Xylene	4.262E-06	2.031E-06	8.878E-08	1.04346E-06	9.61435E-07	0.00000	0.00000
As	3.286E-05	3.072E-05	1.541E-05	2.21865E-05	2.46176E-05	0.00002	0.00003
Be	1.642E-05	7.824E-06	3.421E-07	4.02066E-06	3.70461E-06	0.00000	0.00002
Cd	7.674E-05	0.0001194	8.259E-05	9.65615E-05	0.000111934	0.00008	0.00012
Co	4.606E-06	8.52E-06	6.281E-06	7.06675E-06	8.2648E-06	0.00000	0.00001
Cr	9.319E-05	0.0001498	0.000105	0.0001218	0.000141451	0.00009	0.00015
Hg	3.068E-05	3.419E-05	1.978E-05	2.58939E-05	2.92861E-05	0.00002	0.00003
Mn	5.368E-05	5.419E-05	2.91E-05	4.001E-05	4.47976E-05	0.00003	0.00005
Ni	0.0001316	0.0002208	0.0001574	0.000180689	0.000210325	0.00013	0.00022
Pb	7.668E-05	7.419E-05	3.841E-05	5.4126E-05	6.03091E-05	0.00004	0.00008
POM	0.0001319	6.673E-05	6.561E-06	3.59487E-05	3.42043E-05	0.00001	0.00013
Se	8.211E-05	3.912E-05	1.71E-06	2.01033E-05	1.85231E-05	0.00000	0.00008
Total HAPs	0.1076346	0.1933887	0.1411887	0.159783051	0.186619026	0.10763	0.19339

Table F-1: (continued)							
Description	Steam Plant A, #3	Steam Plant A, #3	Steam Plant A, #3	Steam Plant A, #3	Steam Plant A, #3	Steam Plant A, #3	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	4.109035	7.090772	5.975828	6.9269495	3.4035225	3.40352	7.09077
NOx	4.97657	8.73603	7.18932	8.82945	4.06317	4.06317	8.82945
PM	0.3889723	0.701272	0.555922	0.74492155	0.3102401	0.31024	0.74492
SOx	0.0726297	0.17070954	0.0733438	0.276499568	0.0286828	0.02868	0.27650
VOC	0.26827445	0.46160505	0.3905922	0.448263	0.2227467	0.22275	0.46161
VOC HAP	0.091922953	0.158460494	0.1337391	0.15446735	0.0762063	0.07621	0.15846
TSP HAP	2.24506E-05	7.35222E-05	2.134E-05	0.000141118	0.0002541	0.00002	0.00025
CH4	0.111996382	0.192371298	0.1631691	0.18614229	0.093123	0.09312	0.19237
CO2	859.6343	2984.6002	762.1588	5906.51725	115.04955	115.04955	5906.51725
NH3	0.155384	0.2661296	0.2266304	0.2559776	0.129504	0.12950	0.26613
N2O	0.10749101	0.18527124	0.1563976	0.180550425	0.0891229	0.08912	0.18527
R-113	0	0	0	0	0	0.00000	0.00000
Acetaldehyde					0	0.00000	0.00000
Acrolein					0	0.00000	0.00000
Benzene	0.000103264	0.000179136	0.0001499	0.000176868	8.516E-05	0.00009	0.00018
1,3-Butadiene					0	0.00000	0.00000
2-Butanone					0	0.00000	0.00000
Chloroform					0	0.00000	0.00000
Chloromethane					0	0.00000	0.00000
1,1-Dichloroethene					0	0.00000	0.00000
Ethylbenzene	3.84208E-07	1.33395E-06	3.406E-07	2.63988E-06	5.142E-08	0.00000	0.00000
Ethylene Glycol					0	0.00000	0.00000
Formaldehyde	0.004010314	0.007516827	0.0056384	0.008531433	0.0030846	0.00308	0.00853
Hexane	0.087567912	0.150268728	0.1276254	0.145117068	0.072868	0.07287	0.15027
Methylene Chloride	0	0	0	0	0	0.00000	0.00000
Naphthalene	3.64464E-05	7.44316E-05	4.925E-05	9.56992E-05	2.56E-05	0.00003	0.00010
Phenol	0	0	0	0	0	0.00000	0.00000
Propionaldehyde	0	0	0	0	0	0.00000	0.00000
Styrene	0	0	0	0	0	0.00000	0.00000
Tetrachloroethylene	0	0	0	0	0	0.00000	0.00000
Toluene	0.00020255	0.000412802	0.000274	0.000529323	0.0001426	0.00014	0.00053
1,1,1 Trichloroethane	1.42568E-06	4.94986E-06	1.264E-06	9.79577E-06	1.908E-07	0.00000	0.00001
Trichloroethylene	0	0	0	0	0	0.00000	0.00000
Vinyl Chloride	0	0	0	0	0	0.00000	0.00000
o-Xylene	6.58469E-07	2.28617E-06	5.838E-07	4.52432E-06	8.813E-08	0.00000	0.00000
As	1.30945E-05	2.83785E-05	1.716E-05	3.92428E-05	8.547E-06	0.00001	0.00004
Be	2.53722E-06	8.80908E-06	2.25E-06	1.74332E-05	3.396E-07	0.00000	0.00002
Cd	5.59505E-05	0.000100291	8.015E-05	0.000105425	4.486E-05	0.00004	0.00011
Co	4.07883E-06	6.9859E-06	5.949E-06	6.71941E-06	3.399E-06	0.00000	0.00001
Cr	7.05177E-05	0.000125241	0.0001014	0.000129423	5.7E-05	0.00006	0.00013
Hg	1.51622E-05	3.04321E-05	2.066E-05	3.82313E-05	1.086E-05	0.00001	0.00004
Mn	2.35263E-05	4.92211E-05	3.141E-05	6.52636E-05	1.606E-05	0.00002	0.00007
Ni	0.000104508	0.000183457	0.000151	0.000185418	8.533E-05	0.00009	0.00019
Pb	3.18904E-05	6.801E-05	4.216E-05	9.2296E-05	2.125E-05	0.00002	0.00009
POM	2.24506E-05	7.35222E-05	2.134E-05	0.000141118	4.764E-06	0.00000	0.00014
Se	1.26861E-05	4.40454E-05	1.125E-05	8.71658E-05	1.698E-06	0.00000	0.00009
Total HAPs	0.092279356	0.159178887	0.1342238	0.155375088	0.0764604	0.07646	0.15918

Table F-1: (continued)							
Description	Steam Plant A, #4	Steam Plant A, #4	Steam Plant A, #4	Steam Plant A, #4	Steam Plant A, #4	Steam Plant A, #4	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	0	4.7035835	7.5531235	2.268341	6.2440175	0.00000	7.55312
NOx	0	6.01334	9.08306	2.7016	7.43596	0.00000	9.08306
PM	0	0.50945175	0.70187455	0.2054729	0.56546315	0.00000	0.70187
SOx	0	0.20223162	0.09113298	0.0166673	0.04560321	0.00000	0.20223
VOC	0	0.30422015	0.49372235	0.1485115	0.40881085	0.00000	0.49372
VOC HAP	0	0.104867307	0.169043263	0.0507963	0.13982664	0.00000	0.16904
TSP HAP	0	0.000100026	2.60729E-05	1.679E-06	0.00045345	0.00000	0.00045
CH4	0	0.126287344	0.206260216	0.0621021	0.1709514	0.00000	0.20626
CO2	0	4192.08685	924.30965	12.0955	26.39665	0.00000	4192.08685
NH3	0	0.1735728	0.2865008	0.0863968	0.237832	0.00000	0.28650
N2O	0	0.122571845	0.197683805	0.0594072	0.16352991	0.00000	0.19768
R-113	0	0	0	0	0	0.00000	0.00000
Acetaldehyde					0	0.00000	0.00000
Acrolein					0	0.00000	0.00000
Benzene	0	0.000120211	0.000189406	5.672E-05	0.00015612	0.00000	0.00019
1,3-Butadiene					0	0.00000	0.00000
2-Butanone					0	0.00000	0.00000
Chloroform					0	0.00000	0.00000
Chloromethane					0	0.00000	0.00000
1,1-Dichloroethene					0	0.00000	0.00000
Ethylbenzene	0	1.87362E-06	4.13114E-07	5.406E-09	1.1798E-08	0.00000	0.00000
Ethylene Glycol					0	0.00000	0.00000
Formaldehyde	0	0.005865142	0.007111088	0.0020301	0.0055855	0.00000	0.00711
Hexane	0	0.09843647	0.161333482	0.0486005	0.13378555	0.00000	0.16133
Methylene Chloride	0	0	0	0	0	0.00000	0.00000
Naphthalene	0	6.63766E-05	6.19541E-05	1.657E-05	4.5546E-05	0.00000	0.00007
Phenol	0	0	0	0	0	0.00000	0.00000
Propionaldehyde	0	0	0	0	0	0.00000	0.00000
Styrene	0	0	0	0	0	0.00000	0.00000
Tetrachloroethylene	0	0	0	0	0	0.00000	0.00000
Toluene	0	0.00036707	0.000344679	9.232E-05	0.00025385	0.00000	0.00037
1,1,1 Trichloroethane	0	6.95244E-06	1.53294E-06	2.006E-08	4.3778E-08	0.00000	0.00001
Trichloroethylene	0	0	0	0	0	0.00000	0.00000
Vinyl Chloride	0	0	0	0	0	0.00000	0.00000
o-Xylene	0	3.21109E-06	7.0801E-07	9.265E-09	2.022E-08	0.00000	0.00000
As	0	2.73456E-05	2.15438E-05	5.447E-06	1.4968E-05	0.00000	0.00003
Be	0	1.2373E-05	2.72811E-06	3.57E-08	7.791E-08	0.00000	0.00001
Cd	0	7.20386E-05	0.000101213	2.973E-05	8.1833E-05	0.00000	0.00010
Co	0	4.55629E-06	7.52065E-06	2.268E-06	6.2431E-06	0.00000	0.00001
Cr	0	8.83111E-05	0.000128072	3.783E-05	0.00010413	0.00000	0.00013
Hg	0	2.64758E-05	2.60063E-05	7.055E-06	1.9402E-05	0.00000	0.00003
Mn	0	4.53578E-05	3.94782E-05	1.033E-05	2.8398E-05	0.00000	0.00005
Ni	0	0.00012628	0.000190744	5.673E-05	0.00015616	0.00000	0.00019
Pb	0	6.42397E-05	5.29501E-05	1.361E-05	3.7395E-05	0.00000	0.00006
POM	0	0.000100026	2.60729E-05	1.679E-06	4.4621E-06	0.00000	0.00010
Se	0	6.1865E-05	1.36406E-05	1.785E-07	3.8955E-07	0.00000	0.00006
Total HAPs	0	0.105496176	0.169653233	0.0509612	0.14028009	0.00000	0.16965

Table F-1: (continued)							
Description	Steam Plant B, #5	Steam Plant B, #5	Steam Plant B, #5	Steam Plant B, #5	Steam Plant B, #5	Steam Plant B, #5	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	0.42	0	0	0	0	0.00000	0.42000
NOx	0.5	0	0	0	0	0.00000	0.50000
PM	0.038	0	0	0	0	0.00000	0.03800
SOx	0.003	0	0	0	0	0.00000	0.00300
VOC	0.0275	0	0	0	0	0.00000	0.02750
VOC HAP	0.00940555	0	0	0	0	0.00000	0.00941
TSP HAP	0.000000259	0	0	0	0	0.00000	0.00000
CH4	0.0115	0	0	0	0	0.00000	0.01150
CO2	0	0	0	0	0	0.00000	0.00000
NH3	0.016	0	0	0	0	0.00000	0.01600
N2O	0.011	0	0	0	0	0.00000	0.01100
R-113	0	0	0	0	0	0.00000	0.00000
Acetaldehyde					0	0.00000	0.00000
Acrolein					0	0.00000	0.00000
Benzene	0.0000105	0	0	0	0	0.00000	0.00001
1,3-Butadiene					0	0.00000	0.00000
2-Butanone					0	0.00000	0.00000
Chloroform					0	0.00000	0.00000
Chloromethane					0	0.00000	0.00000
1,1-Dichloroethene					0	0.00000	0.00000
Ethylbenzene	0	0	0	0	0	0.00000	0.00000
Ethylene Glycol					0	0.00000	0.00000
Formaldehyde	0.000375	0	0	0	0	0.00000	0.00038
Hexane	0.009	0	0	0	0	0.00000	0.00900
Methylene Chloride	0	0	0	0	0	0.00000	0.00000
Naphthalene	0.00000305	0	0	0	0	0.00000	0.00000
Phenol	0	0	0	0	0	0.00000	0.00000
Propionaldehyde	0	0	0	0	0	0.00000	0.00000
Styrene	0	0	0	0	0	0.00000	0.00000
Tetrachloroethylene	0	0	0	0	0	0.00000	0.00000
Toluene	0.000017	0	0	0	0	0.00000	0.00002
1,1,1 Trichloroethane	0	0	0	0	0	0.00000	0.00000
Trichloroethylene	0	0	0	0	0	0.00000	0.00000
Vinyl Chloride	0	0	0	0	0	0.00000	0.00000
o-Xylene	0	0	0	0	0	0.00000	0.00000
As	0.000001	0	0	0	0	0.00000	0.00000
Be	0	0	0	0	0	0.00000	0.00000
Cd	0.0000055	0	0	0	0	0.00000	0.00001
Co	0.00000042	0	0	0	0	0.00000	0.00000
Cr	0.000007	0	0	0	0	0.00000	0.00001
Hg	0.0000013	0	0	0	0	0.00000	0.00000
Mn	0.0000019	0	0	0	0	0.00000	0.00000
Ni	0.0000105	0	0	0	0	0.00000	0.00001
Pb	0.0000025	0	0	0	0	0.00000	0.00000
POM	0.000000259	0	0	0	0	0.00000	0.00000
Se	0	0	0	0	0	0.00000	0.00000
Total HAPs	0.009435929	0	0	0	0	0.00000	0.00944

Table F-1: (continued)							
Description	ETF Cont. Air Heaters, #6	ETF Cont. Air Heaters, #6	ETF Cont. Air Heaters, #6	ETF Cont. Air Heaters, #6	ETF Cont. Air Heaters, #6	ETF Cont. Air Heaters, #6	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	0	0.463302	0.379428	0.747894	1.767654	0.00000	1.76765
NOx	0	1.54434	1.26476	2.49298	5.89218	0.00000	5.89218
PM	0	0.0419178	0.0343292	0.0676666	0.1599306	0.00000	0.15993
SOx	0	0.0033093	0.0027102	0.0053421	0.0126261	0.00000	0.01263
VOC	0	0.03033525	0.0248435	0.04896925	0.11573925	0.00000	0.11574
VOC HAP	0	0.01037526	0.00849697	0.01674846	0.03958514	0.00000	0.03959
TSP HAP	0	1.434E-06	1.1744E-06	2.3149E-06	0.00012786	0.00000	0.00013
CH4	0	0.01268565	0.0103891	0.02047805	0.04840005	0.00000	0.04840
CO2	0	661.86	542.04	1068.42	2525.22	0.00000	2525.22000
NH3	0	0.0176496	0.0144544	0.0284912	0.0673392	0.00000	0.06734
N2O	0	0.0121341	0.0099374	0.0195877	0.0462957	0.00000	0.04630
R-113	0	0	0	0	0	0.00000	0.00000
Acetaldehyde					0	0.00000	0.00000
Acrolein					0	0.00000	0.00000
Benzene	0	1.1583E-05	9.4857E-06	1.8697E-05	4.4191E-05	0.00000	0.00004
1,3-Butadiene					0	0.00000	0.00000
2-Butanone					0	0.00000	0.00000
Chloroform					0	0.00000	0.00000
Chloromethane					0	0.00000	0.00000
1,1-Dichloroethene					0	0.00000	0.00000
Ethylbenzene	0	0	0	0	0	0.00000	0.00000
Ethylene Glycol					0	0.00000	0.00000
Formaldehyde	0	0.00041366	0.00033878	0.00066776	0.00157826	0.00000	0.00158
Hexane	0	0.0099279	0.0081306	0.0160263	0.0378783	0.00000	0.03788
Methylene Chloride	0	0	0	0	0	0.00000	0.00000
Naphthalene	0	3.3645E-06	2.7554E-06	5.4311E-06	1.2837E-05	0.00000	0.00001
Phenol	0	0	0	0	0	0.00000	0.00000
Propionaldehyde	0	0	0	0	0	0.00000	0.00000
Styrene	0	0	0	0	0	0.00000	0.00000
Tetrachloroethylene	0	0	0	0	0	0.00000	0.00000
Toluene	0	1.8753E-05	1.5358E-05	3.0272E-05	7.1548E-05	0.00000	0.00007
1,1,1 Trichloroethane	0	0	0	0	0	0.00000	0.00000
Trichloroethylene	0	0	0	0	0	0.00000	0.00000
Vinyl Chloride	0	0	0	0	0	0.00000	0.00000
o-Xylene	0	0	0	0	0	0.00000	0.00000
As	0	1.1031E-06	9.034E-07	1.7807E-06	4.2087E-06	0.00000	0.00000
Be	0	0	0	0	0	0.00000	0.00000
Cd	0	6.0671E-06	4.9687E-06	9.7939E-06	2.3148E-05	0.00000	0.00002
Co	0	4.633E-07	3.7943E-07	7.4789E-07	1.7677E-06	0.00000	0.00000
Cr	0	7.7217E-06	6.3238E-06	1.2465E-05	2.9461E-05	0.00000	0.00003
Hg	0	1.434E-06	1.1744E-06	2.3149E-06	5.4713E-06	0.00000	0.00001
Mn	0	2.0959E-06	1.7165E-06	3.3833E-06	7.9965E-06	0.00000	0.00001
Ni	0	1.1583E-05	9.4857E-06	1.8697E-05	4.4191E-05	0.00000	0.00004
Pb	0	2.7578E-06	2.2585E-06	4.4518E-06	1.0522E-05	0.00000	0.00001
POM	0	2.857E-07	2.3398E-07	4.612E-07	1.0901E-06	0.00000	0.00000
Se	0	0	0	0	0	0.00000	0.00000
Total HAPs	0	0.01040877	0.00852442	0.01680256	0.03971299	0.00000	0.03971

Table F-1: (continued)							
Description	VKF Heaters, #7	VKF Heaters, #7	VKF Heaters, #7	VKF Heaters, #7	VKF Heaters, #7	VKF Heaters, #7	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	10.831632	0.039522	0.007896	0.032445	0.071232	0.00790	10.83163
NOx	14.4554	0.04705	0.0094	0.038625	0.0848	0.00940	14.45540
PM	0.9800048	0.0035758	0.0007144	0.0029355	0.0064448	0.00071	0.98000
SOx	0.0773688	0.0002823	0.0000564	0.00023175	0.0005088	0.00006	0.07737
VOC	0.709214	0.00258775	0.000517	0.00212438	0.004664	0.00052	0.70921
VOC HAP	0	0	0	0	0.001531234	0.00000	0.00153
TSP HAP	0.2328414	0.00084958	0.0001697	0.00069745	0	0.00000	0.23284
CH4	0.2965804	0.00108215	0.0002162	0.00088838	0.0019504	0.00022	0.29658
CO2	15473.76	56.46	11.28	46.35	101.76	11.28000	15473.76000
NH3	0.4126336	0.0015056	0.0003008	0.001236	0.0027136	0.00030	0.41263
N2O	0.2836856	0.0010351	0.0002068	0.00084975	0.0018656	0.00021	0.28369
R-113	0	0	0	0	0	0.00000	0.00000
Acetaldehyde					0	0.00000	0.00000
Acrolein					0	0.00000	0.00000
Benzene	0.00027079	9.8805E-07	1.974E-07	8.1113E-07	1.7808E-06	0.00000	0.00027
1,3-Butadiene					0	0.00000	0.00000
2-Butanone					0	0.00000	0.00000
Chloroform					0	0.00000	0.00000
Chloromethane					0	0.00000	0.00000
1,1-Dichloroethene					0	0.00000	0.00000
Ethylbenzene	0	0	0	0	0	0.00000	0.00000
Ethylene Glycol					0	0.00000	0.00000
Formaldehyde	0	0	0	0	0.0015264	0.00000	0.00153
Hexane	0.2321064	0.0008469	0.0001692	0.00069525	2.8832E-06	0.00000	0.23211
Methylene Chloride	0	0	0	0	0	0.00000	0.00000
Naphthalene	0	0	0	0	0	0.00000	0.00000
Phenol	0	0	0	0	0	0.00000	0.00000
Propionaldehyde	0	0	0	0	0	0.00000	0.00000
Styrene	0	0	0	0	0	0.00000	0.00000
Tetrachloroethylene	0	0	0	0	0	0.00000	0.00000
Toluene	0.00043842	1.5997E-06	3.196E-07	1.3133E-06	2.8832E-06	0.00000	0.00044
1,1,1 Trichloroethane	2.579E-05	9.41E-08	1.88E-08	7.725E-08	1.696E-07	0.00000	0.00003
Trichloroethylene	0	0	0	0	0	0.00000	0.00000
Vinyl Chloride	0	0	0	0	0	0.00000	0.00000
o-Xylene	0	0	0	0	0	0.00000	0.00000
As	2.579E-05	9.41E-08	1.88E-08	7.725E-08	1.696E-07	0.00000	0.00003
Be	0	0	0	0	0	0.00000	0.00000
Cd	0.00014184	5.1755E-07	1.034E-07	4.2488E-07	9.328E-07	0.00000	0.00014
Co	1.0832E-05	3.9522E-08	7.896E-09	3.2445E-08	7.1232E-08	0.00000	0.00001
Cr	0.00018053	6.587E-07	1.316E-07	5.4075E-07	1.1872E-06	0.00000	0.00018
Hg	3.3526E-05	1.2233E-07	2.444E-08	1.0043E-07	2.2048E-07	0.00000	0.00003
Mn	4.9E-05	1.7879E-07	3.572E-08	1.4678E-07	3.2224E-07	0.00000	0.00005
Ni	0.00027079	9.8805E-07	1.974E-07	8.1113E-07	1.7808E-06	0.00000	0.00027
Pb	6.4474E-05	2.3525E-07	4.7E-08	1.9313E-07	0.000000424	0.00000	0.00006
POM	6.6795E-06	2.4372E-08	4.869E-09	2.0008E-08	4.39264E-08	0.00000	0.00001
Se	0	0	0	0	0	0.00000	0.00000
Total HAPs	0.23362487	0.00085244	0.0001703	0.0006998	0.001539269	0.00017	0.23362

Table F-1: (continued)							
Description	PWT Atm Air Dryer, #8	PWT Atm Air Dryer, #8	PWT Atm Air Dryer, #8	PWT Atm Air Dryer, #8	PWT Atm Air Dryer, #8	PWT Atm Air Dryer, #8	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	0	0.285852	0.493626	1.209012	0.329952	0.00000	1.20901
NOx	0	0.3403	0.58765	1.4393	0.3928	0.00000	1.43930
PM	0	0.0258628	0.0446614	0.1093868	0.0298528	0.00000	0.10939
SOx	0	0.0258628	0.0446614	0.1093868	0.0298528	0.00000	0.10939
VOC	0	0.0020418	0.0035259	0.0086358	0.0023568	0.00000	0.00864
VOC HAP	0	0.00640142	0.01105434	0.02707482	0.007389	0.00000	0.02707
TSP HAP	0	0	0	0	0	0.00000	0.00000
CH4	0	0.0078269	0.01351595	0.0331039	0.0090344	0.00000	0.03310
CO2	0	408.36	705.18	1727.16	471.36	0.00000	1727.16000
NH3	0	0.0108896	0.0188048	0.0460576	0.0125696	0.00000	0.04606
N2O	0	0.0074866	0.0129283	0.0316646	0.0086416	0.00000	0.03166
R-113	0	0	0	0	0	0.00000	0.00000
Acetaldehyde					0	0.00000	0.00000
Acrolein					0	0.00000	0.00000
Benzene	0	7.1463E-06	1.2341E-05	3.0225E-05	8.2488E-06	0.00000	0.00003
1,3-Butadiene					0	0.00000	0.00000
2-Butanone					0	0.00000	0.00000
Chloroform					0	0.00000	0.00000
Chloromethane					0	0.00000	0.00000
1,1-Dichloroethene					0	0.00000	0.00000
Ethylbenzene	0	0	0	0	0	0.00000	0.00000
Ethylene Glycol					0	0.00000	0.00000
Formaldehyde	0	0.00025523	0.00044074	0.00107948	0.0002946	0.00000	0.00108
Hexane	0	0.0061254	0.0105777	0.0259074	0.0070704	0.00000	0.02591
Methylene Chloride	0	0	0	0	0	0.00000	0.00000
Naphthalene	0	2.0758E-06	3.5847E-06	8.7797E-06	2.3961E-06	0.00000	0.00001
Phenol	0	0	0	0	0	0.00000	0.00000
Propionaldehyde	0	0	0	0	0	0.00000	0.00000
Styrene	0	0	0	0	0	0.00000	0.00000
Tetrachloroethylene	0	0	0	0	0	0.00000	0.00000
Toluene	0	1.157E-05	1.998E-05	4.8936E-05	1.3355E-05	0.00000	0.00005
1,1,1 Trichloroethane	0	0	0	0	0	0.00000	0.00000
Trichloroethylene	0	0	0	0	0	0.00000	0.00000
Vinyl Chloride	0	0	0	0	0	0.00000	0.00000
o-Xylene	0	0	0	0	0	0.00000	0.00000
As	0	6.806E-07	1.1753E-06	2.8786E-06	7.856E-07	0.00000	0.00000
Be	0	0	0	0	0	0.00000	0.00000
Cd	0	3.7433E-06	6.4642E-06	1.5832E-05	4.3208E-06	0.00000	0.00002
Co	0	2.8585E-07	4.9363E-07	1.209E-06	3.2995E-07	0.00000	0.00000
Cr	0	4.7642E-06	8.2271E-06	2.015E-05	5.4992E-06	0.00000	0.00002
Hg	0	8.8478E-07	1.5279E-06	3.7422E-06	1.0213E-06	0.00000	0.00000
Mn	0	1.2931E-06	2.2331E-06	5.4693E-06	1.4926E-06	0.00000	0.00001
Ni	0	7.1463E-06	1.2341E-05	3.0225E-05	8.2488E-06	0.00000	0.00003
Pb	0	1.7015E-06	2.9383E-06	7.1965E-06	1.964E-06	0.00000	0.00001
POM	0	1.7628E-07	3.044E-07	7.4556E-07	2.0347E-07	0.00000	0.00000
Se	0	0	0	0	0	0.00000	0.00000
Total HAPs	0	0.00642209	0.01109005	0.02716227	0.00741287	0.00000	0.02716

Table F-1: (continued)							
Description	APTU, #14	APTU, #14	APTU, #14	APTU, #14	APTU, #14	APTU, #14	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	100.40625	0.000651896	0.021451462	0	0	0.00000	100.40625
NOx	0	0.003355347	0.05427237	0	0	0.00000	0.05427
PM	0	2.55646E-05	0.000420303	0	0	0.00000	0.00042
SOx	0	1.02258E-06	5.26102E-05	0	0	0.00000	0.00005
VOC	0	0.000102258	0.002488526	0	0	0.00000	0.00249
VOC HAP	0	0	0.000252625	0	0	0.00000	0.00025
TSP HAP	0	0	1.75234E-07	0	0	0.00000	0.00000
CH4	10.5	0	0	0	0	0.00000	10.50000
CO2	0	3.030038347	48.60181508	0	0	0.00000	48.60182
NH3	0	0	0	0	0	0.00000	0.00000
N2O	0	0	0	0	0	0.00000	0.00000
R-113	0	0	0	0	0	0.00000	0.00000
Acetaldehyde	0	0	4.09731E-05	0	0	0.00000	0.00004
Acrolein	0	0	2.01897E-05	0	0	0.00000	0.00002
Benzene	0	0	1.71358E-05	0	0	0.00000	0.00002
1,3-Butadiene	0	0	1.6033E-05	0	0	0.00000	0.00002
2-Butanone					0	0.00000	0.00000
Chloroform					0	0.00000	0.00000
Chloromethane					0	0.00000	0.00000
1,1-Dichloroethene					0	0.00000	0.00000
Ethylbenzene	0	0	1.52695E-06	0	0	0.00000	0.00000
Ethylene Glycol					0	0.00000	0.00000
Formaldehyde	0	0	0.000131318	0	0	0.00000	0.00013
Hexane	0	0	0	0	0	0.00000	0.00000
Methylene Chloride	0	0	0	0	0	0.00000	0.00000
Naphthalene	0	0	5.08983E-06	0	0	0.00000	0.00001
Phenol	0	0	2.20559E-06	0	0	0.00000	0.00000
Propionaldehyde	0	0	8.31339E-06	0	0	0.00000	0.00001
Styrene	0	0	3.47805E-06	0	0	0.00000	0.00000
Tetrachloroethylene	0	0	0	0	0	0.00000	0.00000
Toluene	0	0	4.66568E-06	0	0	0.00000	0.00000
1,1,1 Trichloroethane	0	0	0	0	0	0.00000	0.00000
Trichloroethylene	0	0	0	0	0	0.00000	0.00000
Vinyl Chloride	0	0	0	0	0	0.00000	0.00000
o-Xylene	0	0	1.69661E-06	0	0	0.00000	0.00000
As	0	0	5.43124E-08	0	0	0.00000	0.00000
Be	0	0	0	0	0	0.00000	0.00000
Cd	0	0	5.12381E-09	0	0	0.00000	0.00000
Co	0	0	0	0	0	0.00000	0.00000
Cr	0	0	5.43124E-08	0	0	0.00000	0.00000
Hg	0	0	0	0	0	0.00000	0.00000
Mn	0	0	0	0	0	0.00000	0.00000
Ni	0	0	0	0	0	0.00000	0.00000
Pb	0	0	5.63619E-08	0	0	0.00000	0.00000
POM	0	0	0	0	0	0.00000	0.00000
Se	0	0	5.12381E-09	0	0	0.00000	0.00000
Total HAPs	0	0	0.0002528	0	0	0.00000	0.00025

Table F-1: (continued)							
Description	Liquid Rocket ETF, #17	Liquid Rocket ETF, #17	Liquid Rocket ETF, #17	Liquid Rocket ETF, #17	Liquid Rocket ETF, #17	Liquid Rocket ETF, #17	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	0	0	0	0	0	0.00000	0.00000
NOx	0	0	0	0	0	0.00000	0.00000
PM	0	0	0	0	0	0.00000	0.00000
SOx	0	0	0	0	0	0.00000	0.00000
VOC	0	0	0	0	0	0.00000	0.00000
VOC HAP	0	0	0	0	0	0.00000	0.00000
TSP HAP	0	0	0	0	0	0.00000	0.00000
CH4	0	0	0	0	0	0.00000	0.00000
CO2	0	0	0	0	0	0.00000	0.00000
NH3	0	0	0	0	0	0.00000	0.00000
N2O	0	0	0	0	0	0.00000	0.00000
R-113	0	0	0	0	0	0.00000	0.00000
Acetaldehyde					0	0.00000	0.00000
Acrolein					0	0.00000	0.00000
Benzene					0	0.00000	0.00000
1,3-Butadiene					0	0.00000	0.00000
2-Butanone					0	0.00000	0.00000
Chloroform					0	0.00000	0.00000
Chloromethane					0	0.00000	0.00000
1,1-Dichloroethene					0	0.00000	0.00000
Ethylbenzene					0	0.00000	0.00000
Ethylene Glycol					0	0.00000	0.00000
Formaldehyde	0	0	0	0	0	0.00000	0.00000
Hexane	0	0	0	0	0	0.00000	0.00000
Methylene Chloride	0	0	0	0	0	0.00000	0.00000
Naphthalene	0	0	0	0	0	0.00000	0.00000
Phenol	0	0	0	0	0	0.00000	0.00000
Propionaldehyde	0	0	0	0	0	0.00000	0.00000
Styrene	0	0	0	0	0	0.00000	0.00000
Tetrachloroethylene	0	0	0	0	0	0.00000	0.00000
Toluene	0	0	0	0	0	0.00000	0.00000
1,1,1 Trichloroethane	0	0	0	0	0	0.00000	0.00000
Trichloroethylene	0	0	0	0	0	0.00000	0.00000
Vinyl Chloride	0	0	0	0	0	0.00000	0.00000
o-Xylene	0	0	0	0	0	0.00000	0.00000
As	0	0	0	0	0	0.00000	0.00000
Be	0	0	0	0	0	0.00000	0.00000
Cd	0	0	0	0	0	0.00000	0.00000
Co	0	0	0	0	0	0.00000	0.00000
Cr	0	0	0	0	0	0.00000	0.00000
Hg	0	0	0	0	0	0.00000	0.00000
Mn	0	0	0	0	0	0.00000	0.00000
Ni	0	0	0	0	0	0.00000	0.00000
Pb	0	0	0	0	0	0.00000	0.00000
POM	0	0	0	0	0	0.00000	0.00000
Se	0	0	0	0	0	0.00000	0.00000
Total HAPs	0	0	0	0	0	0.00000	0.00000

Table F-1: (continued)							
Description	Solid Rocket ETF, #18	Solid Rocket ETF, #18	Solid Rocket ETF, #18	Solid Rocket ETF, #18	Solid Rocket ETF, #18	Solid Rocket ETF, #18	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	0	4.045632	7.219104	3.094272	3.335904	0.00000	7.21910
NOx	0	0	0	0	0	0.00000	0.00000
PM	0	0	0	0	0	0.00000	0.00000
SOx	0	0	0	0	0	0.00000	0.00000
VOC	0	0	0	0	0	0.00000	0.00000
VOC HAP	0	0	0	0	0	0.00000	0.00000
TSP HAP	0	0	0	0	0	0.00000	0.00000
CH4	0	0	0	0	0	0.00000	0.00000
CO2	0	0	0	0	0	0.00000	0.00000
NH3	0	0	0	0	0	0.00000	0.00000
N2O	0	0	0	0	0	0.00000	0.00000
R-113	0	0	0	0	0	0.00000	0.00000
Acetaldehyde					0	0.00000	0.00000
Acrolein					0	0.00000	0.00000
Benzene					0	0.00000	0.00000
1,3-Butadiene					0	0.00000	0.00000
2-Butanone					0	0.00000	0.00000
Chloroform					0	0.00000	0.00000
Chloromethane					0	0.00000	0.00000
1,1-Dichloroethene					0	0.00000	0.00000
Ethylbenzene					0	0.00000	0.00000
Ethylene Glycol					0	0.00000	0.00000
Formaldehyde	0	0	0	0	0	0.00000	0.00000
Hexane	0	0	0	0	0	0.00000	0.00000
Methylene Chloride	0	0	0	0	0	0.00000	0.00000
Naphthalene	0	0	0	0	0	0.00000	0.00000
Phenol	0	0	0	0	0	0.00000	0.00000
Propionaldehyde	0	0	0	0	0	0.00000	0.00000
Styrene	0	0	0	0	0	0.00000	0.00000
Tetrachloroethylene	0	0	0	0	0	0.00000	0.00000
Toluene	0	0	0	0	0	0.00000	0.00000
1,1,1 Trichloroethane	0	0	0	0	0	0.00000	0.00000
Trichloroethylene	0	0	0	0	0	0.00000	0.00000
Vinyl Chloride	0	0	0	0	0	0.00000	0.00000
o-Xylene	0	0	0	0	0	0.00000	0.00000
As	0	0	0	0	0	0.00000	0.00000
Be	0	0	0	0	0	0.00000	0.00000
Cd	0	0	0	0	0	0.00000	0.00000
Co	0	0	0	0	0	0.00000	0.00000
Cr	0	0	0	0	0	0.00000	0.00000
Hg	0	0	0	0	0	0.00000	0.00000
Mn	0	0	0	0	0	0.00000	0.00000
Ni	0	0	0	0	0	0.00000	0.00000
Pb	0	0	0	0	0	0.00000	0.00000
POM	0	0	0	0	0	0.00000	0.00000
Se	0	0	0	0	0	0.00000	0.00000
Total HAPs	0	0	0	0	0	0.00000	0.00000

Table F-1: (continued)							
Description	Engine Test Facility, #19	Engine Test Facility, #19	Engine Test Facility, #19	Test Facility, #19	Engine Test Facility, #19	Engine Test Facility, #19	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	0	4.74724117	2.00367405	3.38753814	5.60572038	0.00000	5.60572
NOx	0	8.87292704	3.74500748	6.33154662	10.477485	0.00000	10.47748
PM	0	0.05446821	0.02298947	0.03886744	0.0643181	0.00000	0.06432
SOx	0	0.70983416	0.2996006	0.50652373	0.8381988	0.00000	0.83820
VOC	0	0.38161901	0.16107042	0.27231584	0.45063004	0.00000	0.45063
VOC HAP	0	0.28910989	0.04796677	0.23149316	0.28459513	0.00000	0.28911
TSP HAP	0	0.00093141	0.00039312	0.00066463	0.00109984	0.00000	0.00110
CH4	0	0	0	0	0	0.00000	0.00000
CO2	0	0	0	0	0	0.00000	0.00000
NH3	0	0	0	0	0	0.00000	0.00000
N2O	0	0	0	0	0	0.00000	0.00000
R-113	0	0	0	0	0	0.00000	0.00000
Acetaldehyde	0	0.0184322	0.0077797	0.01315285	0.02176543	0.00000	0.02177
Acrolein	0	0.00908253	0.00383348	0.00648112	0.01072499	0.00000	0.01072
Benzene	0	0.0077087	0.00325362	0.00550078	0.00910273	0.00000	0.00910
1,3-Butadiene	0	0.0072126	0.00304423	0.00514677	0.00851691	0.00000	0.00852
2-Butanone					0	0.00000	0.00000
Chloroform					0	0.00000	0.00000
Chloromethane					0	0.00000	0.00000
1,1-Dichloroethene					0	0.00000	0.00000
Ethylbenzene	0	0.00068691	0.00028993	0.00049017	0.00081113	0.00000	0.00081
Ethylene Glycol	0	0.17546375	0	0.1503975	0.1503975	0.00000	0.17546
Formaldehyde	0	0.05907462	0.0249337	0.04215449	0.06975753	0.00000	0.06976
Hexane	0	0	0	0	0	0.00000	0.00000
Methylene Chloride	0	0	0	0	0	0.00000	0.00000
Naphthalene	0	0.00228971	0.00096642	0.0016339	0.00270378	0.00000	0.00270
Phenol	0	0.00099221	0.00041878	0.00070802	0.00117164	0.00000	0.00117
Propionaldehyde	0	0.00373987	0.00157849	0.0026687	0.00441617	0.00000	0.00442
Styrene	0	0.00156464	0.00066039	0.00111649	0.00184758	0.00000	0.00185
Tetrachloroethylene	0	0	0	0	0	0.00000	0.00000
Toluene	0	0.0020989	0.00088589	0.00149774	0.00247847	0.00000	0.00248
1,1,1 Trichloroethane	0	0	0	0	0	0.00000	0.00000
Trichloroethylene	0	0	0	0	0	0.00000	0.00000
Vinyl Chloride	0	0	0	0	0	0.00000	0.00000
o-Xylene	0	0.00076324	0.00032214	0.00054463	0.00090126	0.00000	0.00090
As	0	0.00028868	0.00012184	0.000206	0.00034089	0.00000	0.00034
Be	0	0	0	0	0	0.00000	0.00000
Cd	0	2.7234E-05	1.1495E-05	1.9434E-05	3.2159E-05	0.00000	0.00003
Co	0	0	0	0	0	0.00000	0.00000
Cr	0	0.00028868	0.00012184	0.000206	0.00034089	0.00000	0.00034
Hg	0	0	0	0	0	0.00000	0.00000
Mn	0	0	0	0	0	0.00000	0.00000
Ni	0	0	0	0	0	0.00000	0.00000
Pb	0	0.00029958	0.00012644	0.00021377	0.00035375	0.00000	0.00035
POM	0	0	0	0	0	0.00000	0.00000
Se	0	2.7234E-05	1.1495E-05	1.9434E-05	3.2159E-05	0.00000	0.00003
Total HAPs	0	0.2900413	0.04835989	0.23215779	0.28569496	0.00000	0.29004

Table F-1: (continued)							
Description	HB1 Heaters, #28	HB1 Heaters, #28	HB1 Heaters, #28	HB1 Heaters, #28	HB1 Heaters, #28	HB1 Heaters, #28	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	9.636786885	0.66339	0	0.4515588	1.4047992	0.00000	9.63679
NOx	24.91967213	0.78975	0	0.53757	1.67238	0.00000	24.91967
PM	1.146747541	0.060021	0	0.04085532	0.12710088	0.00000	1.14675
SOx	0.064534426	0.0047385	0	0.00322542	0.01003428	0.00000	0.06453
VOC	0.71107377	0.04343625	0	0.02956635	0.0919809	0.00000	0.71107
VOC HAP	0.15236991	0.01485607	0	0.010112283	0.031459307	0.00000	0.15237
TSP HAP	0.00049214	4.7984E-05	0	3.26617E-05	0.00010161	0.00000	0.00049
CH4	0.36334918	0.01816425	0	0.01236411	0.03846474	0.00000	0.36335
CO2	20785.57377	947.7	0	645.084	2006.856	0.00000	20785.57377
NH3	0.2592	0.025272	0	0.01720224	0.05351616	0.00000	0.25920
N2O	0.974921311	0.0173745	0	0.01182654	0.03679236	0.00000	0.97492
R-113	0	0	0	0	0	0.00000	0.00000
Acetaldehyde					0	0.00000	0.00000
Acrolein					0	0.00000	0.00000
Benzene	0.0001701	1.6585E-05	0	1.1289E-05	3.512E-05	0.00000	0.00017
1,3-Butadiene					0	0.00000	0.00000
2-Butanone					0	0.00000	0.00000
Chloroform					0	0.00000	0.00000
Chloromethane					0	0.00000	0.00000
1,1-Dichloroethene					0	0.00000	0.00000
Ethylbenzene	0	0	0	0	0	0.00000	0.00000
Ethylene Glycol					0	0.00000	0.00000
Formaldehyde	0.006075	0.00059231	0	0.000403178	0.001254285	0.00000	0.00608
Hexane	0.1458	0.0142155	0	0.00967626	0.03010284	0.00000	0.14580
Methylene Chloride	0	0	0	0	0	0.00000	0.00000
Naphthalene	0.00004941	4.8175E-06	0	3.27918E-06	1.02015E-05	0.00000	0.00005
Phenol	0	0	0	0	0	0.00000	0.00000
Propionaldehyde	0	0	0	0	0	0.00000	0.00000
Styrene	0	0	0	0	0	0.00000	0.00000
Tetrachloroethylene	0	0	0	0	0	0.00000	0.00000
Toluene	0.0002754	2.6852E-05	0	1.82774E-05	5.68609E-05	0.00000	0.00028
1,1,1 Trichloroethane	0	0	0	0	0	0.00000	0.00000
Trichloroethylene	0	0	0	0	0	0.00000	0.00000
Vinyl Chloride	0	0	0	0	0	0.00000	0.00000
o-Xylene	0	0	0	0	0	0.00000	0.00000
As	0.0000162	1.5795E-06	0	1.07514E-06	3.34476E-06	0.00000	0.00002
Be	0	0	0	0	0	0.00000	0.00000
Cd	0.0000891	8.6873E-06	0	5.91327E-06	1.83962E-05	0.00000	0.00009
Co	0.000006804	6.6339E-07	0	4.51559E-07	1.4048E-06	0.00000	0.00001
Cr	0.0001134	1.1057E-05	0	7.52598E-06	2.34133E-05	0.00000	0.00011
Hg	0.00002106	2.0534E-06	0	1.39768E-06	4.34819E-06	0.00000	0.00002
Mn	0.00003078	3.0011E-06	0	2.04277E-06	6.35504E-06	0.00000	0.00003
Ni	0.0001701	1.6585E-05	0	1.1289E-05	3.512E-05	0.00000	0.00017
Pb	0.0000405	3.9488E-06	0	2.68785E-06	8.3619E-06	0.00000	0.00004
POM	4.1958E-06	4.0909E-07	0	2.78461E-07	8.66293E-07	0.00000	0.00000
Se	0	0	0	0	0	0.00000	0.00000
Total HAPs	0.15286205	0.01490405	0	0.010144945	0.031560918	0.00000	0.15286

Table F-1: (continued)							
Description	ASTF Air Heaters, #30 2000	ASTF Air Heaters, #30 2001	ASTF Air Heaters, #30 2002	ASTF Air Heaters, #30 2003	ASTF Air Heaters, #30 2004	ASTF Air Heaters, #30 Minimum	Maximum
CO	3.75	0.2992375	0.4480275	0.113145	0.305655	0.11315	3.75000
NOx	15	1.19695	1.79211	0.45258	1.22262	0.45258	15.00000
PM	2.475	0.19749675	0.29569815	0.0746757	0.2017323	0.07468	2.47500
SOx	5.876	0.3447216	0.83870748	0.21180744	0.61620048	0.21181	5.87600
VOC	0.15	0.0119695	0.0179211	0.0045258	0.0122262	0.00453	0.15000
VOC HAP	0.07212645	0.00575545	0.00861724	0.0021762	0.005878883	0.00218	0.07213
TSP HAP	0.00762	0.00060805	0.00091039	0.00022991	0.000621091	0.00023	0.00762
CH4	0.039	0.00311207	0.00465949	0.00117671	0.003178812	0.00118	0.03900
CO2	16725	1334.59925	1998.20265	504.6267	1363.2213	504.62670	16725.00000
NH3	0	0	0	0	0	0.00000	0.00000
N2O	0.0825	0.00658323	0.00985661	0.00248919	0.00672441	0.00249	0.08250
R-113	0	0	0	0	0	0.00000	0.00000
Acetaldehyde					0	0.00000	0.00000
Acrolein					0	0.00000	0.00000
Benzene	0.0001605	1.2807E-05	1.9176E-05	4.8426E-06	1.3082E-05	0.00000	0.00016
1,3-Butadiene					0	0.00000	0.00000
2-Butanone					0	0.00000	0.00000
Chloroform					0	0.00000	0.00000
Chloromethane					0	0.00000	0.00000
1,1-Dichloroethene					0	0.00000	0.00000
Ethylbenzene	0.0000477	3.8063E-06	5.6989E-06	1.4392E-06	3.88793E-06	0.00000	0.00005
Ethylene Glycol					0	0.00000	0.00000
Formaldehyde	0.04575	0.0036507	0.00546594	0.00138037	0.003728991	0.00138	0.04575
Hexane	0.020412	0.00162881	0.0024387	0.00061587	0.001663741	0.00062	0.02041
Methylene Chloride	0	0	0	0	0	0.00000	0.00000
Naphthalene	0.0008475	6.7628E-05	0.00010125	2.5571E-05	6.9078E-05	0.00003	0.00085
Phenol	0	0	0	0	0	0.00000	0.00000
Propionaldehyde	0	0	0	0	0	0.00000	0.00000
Styrene	0	0	0	0	0	0.00000	0.00000
Tetrachloroethylene	0	0	0	0	0	0.00000	0.00000
Toluene	0.00465	0.00037105	0.00055555	0.0001403	0.000379012	0.00014	0.00465
1,1,1 Trichloroethane	0.000177	1.4124E-05	2.1147E-05	5.3404E-06	1.44269E-05	0.00001	0.00018
Trichloroethylene	0	0	0	0	0	0.00000	0.00000
Vinyl Chloride	0	0	0	0	0	0.00000	0.00000
o-Xylene	0.00008175	6.5234E-06	9.767E-06	2.4666E-06	6.66328E-06	0.00000	0.00008
As	0.00042	3.3515E-05	5.0179E-05	1.2672E-05	3.42334E-05	0.00001	0.00042
Be	0.000315	2.5136E-05	3.7634E-05	9.5042E-06	2.5675E-05	0.00001	0.00032
Cd	0.000315	2.5136E-05	3.7634E-05	9.5042E-06	2.5675E-05	0.00001	0.00032
Co	0	0	0	0	0	0.00000	0.00000
Cr	0.000315	2.5136E-05	3.7634E-05	9.5042E-06	2.5675E-05	0.00001	0.00032
Hg	0.000315	2.5136E-05	3.7634E-05	9.5042E-06	2.5675E-05	0.00001	0.00032
Mn	0.00063	5.0272E-05	7.5269E-05	1.9008E-05	5.135E-05	0.00002	0.00063
Ni	0.000315	2.5136E-05	3.7634E-05	9.5042E-06	2.5675E-05	0.00001	0.00032
Pb	0.000945	7.5408E-05	0.0001129	2.8513E-05	7.70251E-05	0.00003	0.00095
POM	0.002475	0.0001975	0.0002957	7.4676E-05	0.000201732	0.00007	0.00248
Se	0.001575	0.00012568	0.00018817	4.7521E-05	0.000128375	0.00005	0.00158
Total HAPs	0.07974645	0.0063635	0.00952763	0.00240611	0.006499974	0.00241	0.07975

Table F-1: (continued)							
Description	ASTF Test Cells, #31	ASTF Test Cells, #31	ASTF Test Cells, #31	ASTF Test Cells, #31	ASTF Test Cells, #31	ASTF Test Cells, #31	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	0	2.537397114	2.382149175	2.13188524	4.928107708	0.00000	4.92811
NOx	0	4.742573354	4.452404056	3.98464319	9.210979303	0.00000	9.21098
PM	0	0.029113219	0.027331958	0.02446052	0.056543408	0.00000	0.05654
SOx	0	0.379405868	0.356192324	0.31877146	0.736878344	0.00000	0.73688
VOC	0	0.203975097	0.191495098	0.171377	0.396158426	0.00000	0.39616
VOC HAP	0.319025	0.336472534	0.05702724	0.27663232	0.343572229	0.05703	0.34357
TSP HAP	0	0.000497836	0.000467376	0.00041827	0.000966892	0.00000	0.00097
CH4	0	0	0	0	0	0.00000	0.00000
CO2	0	0	0	0	0	0.00000	0.00000
NH3	0	0	0	0	0	0.00000	0.00000
N2O	0	0	0	0	0	0.00000	0.00000
R-113	0	0	0	0	0	0.00000	0.00000
Acetaldehyde	0	0.009851997	0.009249213	0.00827751	0.019134452	0.00000	0.01913
Acrolein	0	0.004854607	0.004557583	0.00407877	0.009428571	0.00000	0.00943
Benzene	0	0.004120297	0.003868201	0.00346182	0.0080024	0.00000	0.00800
1,3-Butadiene	0	0.003855129	0.003619257	0.00323903	0.007487394	0.00000	0.00749
2-Butanone					0	0.00000	0.00000
Chloroform					0	0.00000	0.00000
Chloromethane					0	0.00000	0.00000
1,1-Dichloroethene					0	0.00000	0.00000
Ethylbenzene	0	0.000367155	0.000344691	0.00030848	0.000713085	0.00000	0.00071
Ethylene Glycol	0.319025	0.27572875	0	0.22559625	0.22559625	0.00000	0.31903
Formaldehyde	0	0.031575345	0.029643441	0.02652916	0.061325324	0.00000	0.06133
Hexane	0	0	0	0	0	0.00000	0.00000
Methylene Chloride	0	0	0	0	0	0.00000	0.00000
Naphthalene	0	0.001223851	0.001148971	0.00102826	0.002376951	0.00000	0.00238
Phenol	0	0.000530335	0.000497887	0.00044558	0.001030012	0.00000	0.00103
Propionaldehyde	0	0.001998956	0.001876652	0.00167949	0.003882353	0.00000	0.00388
Styrene	0	0.000836298	0.00078513	0.00070265	0.00162425	0.00000	0.00162
Tetrachloroethylene	0	0	0	0	0	0.00000	0.00000
Toluene	0	0.001121863	0.001053223	0.00094257	0.002178871	0.00000	0.00218
1,1,1 Trichloroethane	0	0	0	0	0	0.00000	0.00000
Trichloroethylene	0	0	0	0	0	0.00000	0.00000
Vinyl Chloride	0	0	0	0	0	0.00000	0.00000
o-Xylene	0	0.00040795	0.00038299	0.00034275	0.000792317	0.00000	0.00079
As	0	0.0001543	0.000144859	0.00012964	0.00029968	0.00000	0.00030
Be	0	0	0	0	0	0.00000	0.00000
Cd	0	1.45566E-05	1.3666E-05	1.223E-05	2.82717E-05	0.00000	0.00003
Co	0	0	0	0	0	0.00000	0.00000
Cr	0	0.0001543	0.000144859	0.00012964	0.00029968	0.00000	0.00030
Hg	0	0	0	0	0	0.00000	0.00000
Mn	0	0	0	0	0	0.00000	0.00000
Ni	0	0	0	0	0	0.00000	0.00000
Pb	0	0.000160123	0.000150326	0.00013453	0.000310989	0.00000	0.00031
POM	0	0	0	0	0	0.00000	0.00000
Se	0	1.45566E-05	1.3666E-05	1.223E-05	2.82717E-05	0.00000	0.00003
Total HAPs	0.319025	0.33697037	0.057494617	0.27705059	0.344539121	0.05749	0.34454

Table F-1: (continued)							
Description	VKF Aux Mass Heater, #35	VKF Aux Mass Heater, #35	VKF Aux Mass Heater, #35	VKF Aux Mass Heater, #35	VKF Aux Mass Heater, #35	VKF Aux Mass Heater, #35	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	5.88672	0.02688	0	0	0.08488032	0.00000	5.88672
NOx	19.6224	0.0896	0	0	0.2829344	0.00000	19.62240
PM	0.532608	0.002432	0	0	0.00767965	0.00000	0.53261
SOx	0.042048	0.000192	0	0	0.00060629	0.00000	0.04205
VOC	0.38544	0.00176	0	0	0.00555764	0.00000	0.38544
VOC HAP	0.131828189	0.000601955	0	0	0.00190082	0.00000	0.13183
TSP HAP	0.000425792	1.94426E-06	0	0	6.1395E-06	0.00000	0.00043
CH4	0.161184	0.000736	0	0	0.0023241	0.00000	0.16118
CO2	8409.6	38.4	0	0	121.2576	0.00000	8409.60000
NH3	0.224256	0.001024	0	0	0.00323354	0.00000	0.22426
N2O	0.154176	0.000704	0	0	0.00222306	0.00000	0.15418
R-113	0	0	0	0	0	0.00000	0.00000
Acetaldehyde					0	0.00000	0.00000
Acrolein					0	0.00000	0.00000
Benzene	0.224256	0.001024	0	0	2.122E-06	0.00000	0.22426
1,3-Butadiene					0	0.00000	0.00000
2-Butanone					0	0.00000	0.00000
Chloroform					0	0.00000	0.00000
Chloromethane					0	0.00000	0.00000
1,1-Dichloroethene					0	0.00000	0.00000
Ethylbenzene					0	0.00000	0.00000
Ethylene Glycol					0	0.00000	0.00000
Formaldehyde	0.154176	0.000704	0	0	7.5786E-05	0.00000	0.15418
Hexane	0	0	0	0	0.00181886	0.00000	0.00182
Methylene Chloride	0	0	0	0	0	0.00000	0.00000
Naphthalene	0	0	0	0	0	0.00000	0.00000
Phenol	0	0	0	0	0	0.00000	0.00000
Propionaldehyde	0	0	0	0	0	0.00000	0.00000
Styrene	0	0	0	0	0	0.00000	0.00000
Tetrachloroethylene	0	0	0	0	0	0.00000	0.00000
Toluene	0	0	0	0	0	0.00000	0.00000
1,1,1 Trichloroethane	0	0	0	0	0	0.00000	0.00000
Trichloroethylene	0	0	0	0	0	0.00000	0.00000
Vinyl Chloride	0	0	0	0	0	0.00000	0.00000
o-Xylene	0	0	0	0	0	0.00000	0.00000
As	0	0	0	0	2.021E-07	0.00000	0.00000
Be	0	0	0	0	0	0.00000	0.00000
Cd	0	0	0	0	1.1115E-06	0.00000	0.00000
Co	0	0	0	0	8.488E-08	0.00000	0.00000
Cr	0	0	0	0	1.4147E-06	0.00000	0.00000
Hg	0.005256	0.000024	0	0	2.6272E-07	0.00000	0.00526
Mn	0	0	0	0	3.8398E-07	0.00000	0.00000
Ni	0	0	0	0	2.122E-06	0.00000	0.00000
Pb	0	0	0	0	5.0524E-07	0.00000	0.00000
POM	0	0	0	0	5.2343E-08	0.00000	0.00000
Se	0	0	0	0	0	0.00000	0.00000
Total HAPs	0.383688	0.001752	0	0	0.00190291	0.00000	0.38369

Table F-1: (continued)							
Description	Chemical Cleaning, #40	Chemical Cleaning, #40	Chemical Cleaning, #40	Chemical Cleaning, #40	Chemical Cleaning, #40	Chemical Cleaning, #40	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	0	0	0	0	0	0.00000	0.00000
NOx	0	0	0	0	0	0.00000	0.00000
PM	0	0	0	0	0	0.00000	0.00000
SOx	0	0	0	0	0	0.00000	0.00000
VOC	0	0	0	0	0.4366742	0.00000	0.43667
VOC HAP	0	0	0	0	0.01344113	0.00000	0.01344
TSP HAP	0	0	0	0	0	0.00000	0.00000
CH4	0	0	0	0	0	0.00000	0.00000
CO2	0	0	0	0	0	0.00000	0.00000
NH3	0	0	0	0	0	0.00000	0.00000
N2O	0	0	0	0	0	0.00000	0.00000
R-113	0.1316614	0.1316614	0.1316614	0.07241377	0.33573657	0.07241	0.33574
Acetaldehyde					0	0.00000	0.00000
Acrolein					0	0.00000	0.00000
Benzene					0	0.00000	0.00000
1,3-Butadiene					0	0.00000	0.00000
2-Butanone					0	0.00000	0.00000
Chloroform					0	0.00000	0.00000
Chloromethane					0	0.00000	0.00000
1,1-Dichloroethene					0	0.00000	0.00000
Ethylbenzene					0	0.00000	0.00000
Ethylene Glycol					0	0.00000	0.00000
Formaldehyde	0	0	0	0	0	0.00000	0.00000
Hexane	0	0	0	0	0	0.00000	0.00000
Methylene Chloride	0	0	0	0	0	0.00000	0.00000
Naphthalene	0	0	0	0	0	0.00000	0.00000
Phenol	0	0	0	0	0	0.00000	0.00000
Propionaldehyde	0	0	0	0	0	0.00000	0.00000
Styrene	0	0	0	0	0	0.00000	0.00000
Tetrachloroethylene	0	0.01344113	0	0	0.01344113	0.00000	0.01344
Toluene	0	0	0	0	0	0.00000	0.00000
1,1,1 Trichloroethane	0	0	0	0	0	0.00000	0.00000
Trichloroethylene	0	0	0	0	0	0.00000	0.00000
Vinyl Chloride	0	0	0	0	0	0.00000	0.00000
o-Xylene	0	0	0	0	0	0.00000	0.00000
As	0	0	0	0	0	0.00000	0.00000
Be	0	0	0	0	0	0.00000	0.00000
Cd	0	0	0	0	0	0.00000	0.00000
Co	0	0	0	0	0	0.00000	0.00000
Cr	0	0	0	0	0	0.00000	0.00000
Hg	0	0	0	0	0	0.00000	0.00000
Mn	0	0	0	0	0	0.00000	0.00000
Ni	0	0	0	0	0	0.00000	0.00000
Pb	0	0	0	0	0	0.00000	0.00000
POM	0	0	0	0	0	0.00000	0.00000
Se	0	0	0	0	0	0.00000	0.00000
Total HAPs	0	0.01344113	0	0	0.01344113	0.00000	0.01344

Table F-1: (continued)							
Description	Arc Heaters, #42	Arc Heaters, #42	Arc Heaters, #42	Arc Heaters, #42	Arc Heaters, #42	Arc Heaters, #42	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	0	0	0	0	0	0.00000	0.00000
NOx	0	0.3402	0.408954	0.32508	0.3491271	0.00000	0.40895
PM	0	0	0	0	0	0.00000	0.00000
SOx	0	0	0	0	0	0.00000	0.00000
VOC	0	0	0	0	0	0.00000	0.00000
VOC HAP	0	0	0	0	0	0.00000	0.00000
TSP HAP	0	0	0	0	0	0.00000	0.00000
CH4	0	0	0	0	0	0.00000	0.00000
CO2	0	0	0	0	0	0.00000	0.00000
NH3	0	0	0	0	0	0.00000	0.00000
N2O	0	0	0	0	0	0.00000	0.00000
R-113	0	0	0	0	0	0.00000	0.00000
Acetaldehyde					0	0.00000	0.00000
Acrolein					0	0.00000	0.00000
Benzene					0	0.00000	0.00000
1,3-Butadiene					0	0.00000	0.00000
2-Butanone					0	0.00000	0.00000
Chloroform					0	0.00000	0.00000
Chloromethane					0	0.00000	0.00000
1,1-Dichloroethene					0	0.00000	0.00000
Ethylbenzene					0	0.00000	0.00000
Ethylene Glycol					0	0.00000	0.00000
Formaldehyde	0	0	0	0	0	0.00000	0.00000
Hexane	0	0	0	0	0	0.00000	0.00000
Methylene Chloride	0	0	0	0	0	0.00000	0.00000
Naphthalene	0	0	0	0	0	0.00000	0.00000
Phenol	0	0	0	0	0	0.00000	0.00000
Propionaldehyde	0	0	0	0	0	0.00000	0.00000
Styrene	0	0	0	0	0	0.00000	0.00000
Tetrachloroethylene	0	0	0	0	0	0.00000	0.00000
Toluene	0	0	0	0	0	0.00000	0.00000
1,1,1 Trichloroethane	0	0	0	0	0	0.00000	0.00000
Trichloroethylene	0	0	0	0	0	0.00000	0.00000
Vinyl Chloride	0	0	0	0	0	0.00000	0.00000
o-Xylene	0	0	0	0	0	0.00000	0.00000
As	0	0	0	0	0	0.00000	0.00000
Be	0	0	0	0	0	0.00000	0.00000
Cd	0	0	0	0	0	0.00000	0.00000
Co	0	0	0	0	0	0.00000	0.00000
Cr	0	0	0	0	0	0.00000	0.00000
Hg	0	0	0	0	0	0.00000	0.00000
Mn	0	0	0	0	0	0.00000	0.00000
Ni	0	0	0	0	0	0.00000	0.00000
Pb	0	0	0	0	0	0.00000	0.00000
POM	0	0	0	0	0	0.00000	0.00000
Se	0	0	0	0	0	0.00000	0.00000
Total HAPs	0	0	0	0	0	0.00000	0.00000

Table F-1: (continued)							
Description	J-6 Steam Plant, #43	J-6 Steam Plant, #43	J-6 Steam Plant, #43	J-6 Steam Plant, #43	J-6 Steam Plant, #43	J-6 Steam Plant, #43	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	0	0.445368	0.396816	0.50652	0.264726	0.00000	0.50652
NOx	0	0.5302	0.4724	0.603	0.31515	0.00000	0.60300
PM	0	0.0402952	0.0359024	0.045828	0.0239514	0.00000	0.04583
SOx	0	0.0031812	0.0028344	0.003618	0.0018909	0.00000	0.00362
VOC	0	0.029161	0.025982	0.033165	0.01733325	0.00000	0.03317
VOC HAP	0	0.0099736	0.008886364	0.011343093	0.005928318	0.00000	0.01134
TSP HAP	0	3.221E-05	2.87021E-05	3.66371E-05	1.91479E-05	0.00000	0.00004
CH4	0	0.0121946	0.0108652	0.013869	0.00724845	0.00000	0.01387
CO2	0	636.24	566.88	723.6	378.18	0.00000	723.60000
NH3	0	0.0169664	0.0151168	0.019296	0.0100848	0.00000	0.01930
N2O	0	0.0116644	0.0103928	0.013266	0.0069333	0.00000	0.01327
R-113	0	0	0	0	0	0.00000	0.00000
Acetaldehyde					0	0.00000	0.00000
Acrolein					0	0.00000	0.00000
Benzene	0	1.113E-05	9.9204E-06	0.000012663	6.61815E-06	0.00000	0.00001
1,3-Butadiene					0	0.00000	0.00000
2-Butanone					0	0.00000	0.00000
Chloroform					0	0.00000	0.00000
Chloromethane					0	0.00000	0.00000
1,1-Dichloroethene					0	0.00000	0.00000
Ethylbenzene	0	0	0	0	0	0.00000	0.00000
Ethylene Glycol					0	0.00000	0.00000
Formaldehyde	0	0.0003977	0.0003543	0.00045225	0.000236363	0.00000	0.00045
Hexane	0	0.0095436	0.0085032	0.010854	0.0056727	0.00000	0.01085
Methylene Chloride	0	0	0	0	0	0.00000	0.00000
Naphthalene	0	3.234E-06	2.88164E-06	3.6783E-06	1.92242E-06	0.00000	0.00000
Phenol	0	0	0	0	0	0.00000	0.00000
Propionaldehyde	0	0	0	0	0	0.00000	0.00000
Styrene	0	0	0	0	0	0.00000	0.00000
Tetrachloroethylene	0	0	0	0	0	0.00000	0.00000
Toluene	0	1.803E-05	1.60616E-05	0.000020502	1.07151E-05	0.00000	0.00002
1,1,1 Trichloroethane	0	0	0	0	0	0.00000	0.00000
Trichloroethylene	0	0	0	0	0	0.00000	0.00000
Vinyl Chloride	0	0	0	0	0	0.00000	0.00000
o-Xylene	0	0	0	0	0	0.00000	0.00000
As	0	1.06E-06	9.448E-07	0.000001206	6.303E-07	0.00000	0.00000
Be	0	0	0	0	0	0.00000	0.00000
Cd	0	5.832E-06	5.1964E-06	0.000006633	3.46665E-06	0.00000	0.00001
Co	0	4.454E-07	3.96816E-07	5.0652E-07	2.64726E-07	0.00000	0.00000
Cr	0	7.423E-06	6.6136E-06	0.000008442	4.4121E-06	0.00000	0.00001
Hg	0	1.379E-06	1.22824E-06	1.5678E-06	8.1939E-07	0.00000	0.00000
Mn	0	2.015E-06	1.79512E-06	2.2914E-06	1.19757E-06	0.00000	0.00000
Ni	0	1.113E-05	9.9204E-06	0.000012663	6.61815E-06	0.00000	0.00001
Pb	0	2.651E-06	0.000002362	0.000003015	1.57575E-06	0.00000	0.00000
POM	0	2.746E-07	2.44703E-07	3.12354E-07	1.63248E-07	0.00000	0.00000
Se	0	0	0	0	0	0.00000	0.00000
Total HAPs	0	0.0100059	0.008915066	0.01137973	0.005947466	0.00000	0.01138

Table F-1: (continued)							
Description	ASTF Air Stripper, #45	ASTF Air Stripper, #45	ASTF Air Stripper, #45	ASTF Air Stripper, #45	ASTF Air Stripper, #45	ASTF Air Stripper, #45	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	0	0	0	0	0	0.00000	0.00000
NOx	0	0	0	0	0	0.00000	0.00000
PM	0	0	0	0	0	0.00000	0.00000
SOx	0	0	0	0	0	0.00000	0.00000
VOC	0.29814863	0.29814863	0.2981486	0.425605	0.3027585	0.29815	0.42561
VOC HAP	0.10250826	0.10250826	0.1025083	0.12870118	0.100879	0.10088	0.12870
TSP HAP	0	0	0	0	0	0.00000	0.00000
CH4	0	0	0	0	0	0.00000	0.00000
CO2	0	0	0	0	0	0.00000	0.00000
NH3	0	0	0	0	0	0.00000	0.00000
N2O	0	0	0	0	0	0.00000	0.00000
R-113	0	0	0	0	0	0.00000	0.00000
Acetaldehyde					0	0.00000	0.00000
Acrolein					0	0.00000	0.00000
Benzene					0	0.00000	0.00000
1,3-Butadiene					0	0.00000	0.00000
2-Butanone					0.0043252	0.00433	0.00433
Chloroform					0.0001391	0.00014	0.00014
Chloromethane					0	0.00000	0.00000
1,1-Dichloroethene					7.716E-06	0.00001	0.00001
Ethylbenzene					0	0.00000	0.00000
Ethylene Glycol					0	0.00000	0.00000
Formaldehyde	0	0	0	0	0	0.00000	0.00000
Hexane	0	0	0	0	0	0.00000	0.00000
Methylene Chloride	0	0	0	0.00085752	5.106E-05	0.00000	0.00086
Naphthalene	0	0	0	0	0	0.00000	0.00000
Phenol	0	0	0	0	0	0.00000	0.00000
Propionaldehyde	0	0	0	0	0	0.00000	0.00000
Styrene	0	0	0	0	0	0.00000	0.00000
Tetrachloroethylene	0	0	0	0	0	0.00000	0.00000
Toluene	0	0	0	0	0	0.00000	0.00000
1,1,1 Trichloroethane	0	0	0	0	0	0.00000	0.00000
Trichloroethylene	0.04145806	0.04145806	0.0414581	0.07071694	0.0333308	0.03333	0.07072
Vinyl Chloride	0.05652311	0.05652311	0.0565231	0.05707157	0.0630252	0.05652	0.06303
o-Xylene	0	0	0	0	0	0.00000	0.00000
As	0	0	0	0	0	0.00000	0.00000
Be	0	0	0	0	0	0.00000	0.00000
Cd	0	0	0	0	0	0.00000	0.00000
Co	0	0	0	0	0	0.00000	0.00000
Cr	0	0	0	0	0	0.00000	0.00000
Hg	0	0	0	0	0	0.00000	0.00000
Mn	0	0	0	0	0	0.00000	0.00000
Ni	0	0	0	0	0	0.00000	0.00000
Pb	0	0	0	0	0	0.00000	0.00000
POM	0	0	0	0	0	0.00000	0.00000
Se	0	0	0	0	0	0.00000	0.00000
Total HAPs	0.09798117	0.09798117	0.0979812	0.12864604	0.100879	0.09798	0.12865

Table F-1: (continued)							
Description	T-3 Air Heater, #46	T-3 Air Heater, #46	T-3 Air Heater, #46	T-3 Air Heater, #46	T-3 Air Heater, #46	T-3 Air Heater, #46	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	0	0.23205	0.175014	0	0.013524	0.00000	0.23205
NOx	0	0.7735	0.58338	0	0.04508	0.00000	0.77350
PM	0	0.020995	0.0158346	0	0.0012236	0.00000	0.02100
SOx	0	0.0016575	0.0012501	0	0.0000966	0.00000	0.00166
VOC	0	0.01519375	0.01145925	0	0.0008855	0.00000	0.01519
VOC HAP	0	0.005196566	0.003919293	0	0.00030286	0.00000	0.00520
TSP HAP	0	1.67844E-05	1.26589E-05	0	9.782E-07	0.00000	0.00002
CH4	0	0.00635375	0.00479205	0	0.0003703	0.00000	0.00635
CO2	0	331.5	250.02	0	19.32	0.00000	331.50000
NH3	0	0.00884	0.0066672	0	0.0005152	0.00000	0.00884
N2O	0	0.0060775	0.0045837	0	0.0003542	0.00000	0.00608
R-113	0	0	0	0	0	0.00000	0.00000
Acetaldehyde					0	0.00000	0.00000
Acrolein					0	0.00000	0.00000
Benzene	0	5.80125E-06	4.37535E-06	0	3.381E-07	0.00000	0.00001
1,3-Butadiene					0	0.00000	0.00000
2-Butanone					0	0.00000	0.00000
Chloroform					0	0.00000	0.00000
Chloromethane					0	0.00000	0.00000
1,1-Dichloroethene					0	0.00000	0.00000
Ethylbenzene	0	0	0	0	0	0.00000	0.00000
Ethylene Glycol					0	0.00000	0.00000
Formaldehyde	0	0.000207188	0.000156263	0	1.2075E-05	0.00000	0.00021
Hexane	0	0.0049725	0.0037503	0	0.0002898	0.00000	0.00497
Methylene Chloride	0	0	0	0	0	0.00000	0.00000
Naphthalene	0	1.68513E-06	1.27094E-06	0	9.821E-08	0.00000	0.00000
Phenol	0	0	0	0	0	0.00000	0.00000
Propionaldehyde	0	0	0	0	0	0.00000	0.00000
Styrene	0	0	0	0	0	0.00000	0.00000
Tetrachloroethylene	0	0	0	0	0	0.00000	0.00000
Toluene	0	9.3925E-06	7.0839E-06	0	5.474E-07	0.00000	0.00001
1,1,1 Trichloroethane	0	0	0	0	0	0.00000	0.00000
Trichloroethylene	0	0	0	0	0	0.00000	0.00000
Vinyl Chloride	0	0	0	0	0	0.00000	0.00000
o-Xylene	0	0	0	0	0	0.00000	0.00000
As	0	5.525E-07	4.167E-07	0	3.22E-08	0.00000	0.00000
Be	0	0	0	0	0	0.00000	0.00000
Cd	0	3.03875E-06	2.29185E-06	0	1.771E-07	0.00000	0.00000
Co	0	2.3205E-07	1.75014E-07	0	1.3524E-08	0.00000	0.00000
Cr	0	3.8675E-06	2.9169E-06	0	2.254E-07	0.00000	0.00000
Hg	0	7.1825E-07	5.4171E-07	0	4.186E-08	0.00000	0.00000
Mn	0	1.04975E-06	7.9173E-07	0	6.118E-08	0.00000	0.00000
Ni	0	5.80125E-06	4.37535E-06	0	3.381E-07	0.00000	0.00001
Pb	0	1.38125E-06	1.04175E-06	0	8.05E-08	0.00000	0.00000
POM	0	1.43098E-07	1.07925E-07	0	8.3398E-09	0.00000	0.00000
Se	0	0	0	0	0	0.00000	0.00000
Total HAPs	0	0.005213351	0.003931952	0	0.00030384	0.00000	0.00521

Table F-1: (continued)							
Description	Test Model Combustor, #52	Test Model Combustor, #52	Test Model Combustor, #52	Test Model Combustor, #52	Test Model Combustor, #52	Test Model Combustor, #52	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	0	0	0	0	0	0.00000	0.00000
NOx	0	0	0	0	0	0.00000	0.00000
PM	0	0	0	0	0	0.00000	0.00000
SOx	0	0	0	0	0	0.00000	0.00000
VOC	0	0	0	0	0	0.00000	0.00000
VOC HAP	0	0	0	0	0	0.00000	0.00000
TSP HAP	0	0	0	0	0	0.00000	0.00000
CH4	0	0	0	0	0	0.00000	0.00000
CO2	0	0	0	0	0	0.00000	0.00000
NH3	0	0	0	0	0	0.00000	0.00000
N2O	0	0	0	0	0	0.00000	0.00000
R-113	0	0	0	0	0	0.00000	0.00000
Acetaldehyde	0	0	0	0	0	0.00000	0.00000
Acrolein	0	0	0	0	0	0.00000	0.00000
Benzene	0	0	0	0	0	0.00000	0.00000
1,3-Butadiene	0	0	0	0	0	0.00000	0.00000
2-Butanone					0	0.00000	0.00000
Chloroform					0	0.00000	0.00000
Chloromethane					0	0.00000	0.00000
1,1-Dichloroethene					0	0.00000	0.00000
Ethylbenzene	0	0	0	0	0	0.00000	0.00000
Ethylene Glycol					0	0.00000	0.00000
Formaldehyde	0	0	0	0	0	0.00000	0.00000
Hexane	0	0	0	0	0	0.00000	0.00000
Methylene Chloride	0	0	0	0	0	0.00000	0.00000
Naphthalene	0	0	0	0	0	0.00000	0.00000
Phenol	0	0	0	0	0	0.00000	0.00000
Propionaldehyde	0	0	0	0	0	0.00000	0.00000
Styrene	0	0	0	0	0	0.00000	0.00000
Tetrachloroethylene	0	0	0	0	0	0.00000	0.00000
Toluene	0	0	0	0	0	0.00000	0.00000
1,1,1 Trichloroethane	0	0	0	0	0	0.00000	0.00000
Trichloroethylene	0	0	0	0	0	0.00000	0.00000
Vinyl Chloride	0	0	0	0	0	0.00000	0.00000
o-Xylene	0	0	0	0	0	0.00000	0.00000
As	0	0	0	0	0	0.00000	0.00000
Be	0	0	0	0	0	0.00000	0.00000
Cd	0	0	0	0	0	0.00000	0.00000
Co	0	0	0	0	0	0.00000	0.00000
Cr	0	0	0	0	0	0.00000	0.00000
Hg	0	0	0	0	0	0.00000	0.00000
Mn	0	0	0	0	0	0.00000	0.00000
Ni	0	0	0	0	0	0.00000	0.00000
Pb	0	0	0	0	0	0.00000	0.00000
POM	0	0	0	0	0	0.00000	0.00000
Se	0	0	0	0	0	0.00000	0.00000
Total HAPs	0	0	0	0	0	0.00000	0.00000

Table F-1: (continued)							
Description	SL1 Test Cell, #53	SL1 Test Cell, #53	SL1 Test Cell, #53	SL1 Test Cell, #53	SL1 Test Cell, #53	SL1 Test Cell, #53	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	8.54001685	0	0	0	0	0.00000	8.54002
NOx	18.0720823	0	0	0	0	0.00000	18.07208
PM	3.61441646	0	0	0	0	0.00000	3.61442
SOx	0.41628387	0	0	0	0	0.00000	0.41628
VOC	0.72815932	0	0	0	0	0.00000	0.72816
VOC HAP	0.21684584	0	0	0	0	0.00000	0.21685
TSP HAP	0.00711845	0	0	0	0	0.00000	0.00712
CH4	0	0	0	0	0	0.00000	0.00000
CO2	0	0	0	0	0	0.00000	0.00000
NH3	0	0	0	0	0	0.00000	0.00000
N2O	0	0	0	0	0	0.00000	0.00000
R-113	0	0	0	0	0	0.00000	0.00000
Acetaldehyde	0.03517009	0	0	0	0	0.00000	0.03517
Acrolein	0.01733019	0	0	0	0	0.00000	0.01733
Benzene	0.01470882	0	0	0	0	0.00000	0.01471
1,3-Butadiene	0.01376221	0	0	0	0	0.00000	0.01376
2-Butanone					0	0.00000	0.00000
Chloroform					0	0.00000	0.00000
Chloromethane					0	0.00000	0.00000
1,1-Dichloroethene					0	0.00000	0.00000
Ethylbenzene	0.00131069	0	0	0	0	0.00000	0.00131
Ethylene Glycol					0	0.00000	0.00000
Formaldehyde	0.11271906	0	0	0	0	0.00000	0.11272
Hexane	0	0	0	0	0	0.00000	0.00000
Methylene Chloride	0	0	0	0	0	0.00000	0.00000
Naphthalene	0.00436896	0	0	0	0	0.00000	0.00437
Phenol	0.00189321	0	0	0	0	0.00000	0.00189
Propionaldehyde	0.00713596	0	0	0	0	0.00000	0.00714
Styrene	0.00298545	0	0	0	0	0.00000	0.00299
Tetrachloroethylene	0	0	0	0	0	0.00000	0.00000
Toluene	0.00400488	0	0	0	0	0.00000	0.00400
1,1,1 Trichloroethane	0	0	0	0	0	0.00000	0.00000
Trichloroethylene	0	0	0	0	0	0.00000	0.00000
Vinyl Chloride	0	0	0	0	0	0.00000	0.00000
o-Xylene	0.00145632	0	0	0	0	0.00000	0.00146
As	0.0022063	0	0	0	0	0.00000	0.00221
Be	0	0	0	0	0	0.00000	0.00000
Cd	0.00020814	0	0	0	0	0.00000	0.00021
Co	0	0	0	0	0	0.00000	0.00000
Cr	0.0022063	0	0	0	0	0.00000	0.00221
Hg	0	0	0	0	0	0.00000	0.00000
Mn	0	0	0	0	0	0.00000	0.00000
Ni	0	0	0	0	0	0.00000	0.00000
Pb	0.00228956	0	0	0	0	0.00000	0.00229
POM	0	0	0	0	0	0.00000	0.00000
Se	0.00020814	0	0	0	0	0.00000	0.00021
Total HAPs	0.2239643	0	0	0	0	0.00000	0.22396

Table F-1: (continued)							
Description	Westinghouse Test Rig, #54	Westinghouse Test Rig, #54	Westinghouse Test Rig, #54	Westinghouse Test Rig, #54	Westinghouse Test Rig, #54	Westinghouse Test Rig, #54	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	3.88327139	0.072965857	0.053508	0	0	0.00000	3.88327
NOx	12.94482156	0.257731429	0.17836	0	0	0.00000	12.94482
PM	0.351842157	0.018998986	0.0048412	0	0	0.00000	0.35184
SOx	0.028991961	0.019173129	0.0003822	0	0	0.00000	0.02899
VOC	0.254239516	0.004222964	0.0035035	0	0	0.00000	0.25424
VOC HAP	0.08695986	0.001565213	0.001198267	0	0	0.00000	0.08696
TSP HAP	0.000153236	2.91726E-05	2.09688E-06	0	0	0.00000	0.00015
CH4	0.106312804	0.001628236	0.0014651	0	0	0.00000	0.10631
CO2	5550.184238	170.2246429	76.44	0	0	0.00000	5550.18424
NH3	0.1479008	0.0019504	0.0020384	0	0	0.00000	0.14790
N2O	0.101701059	0.001819793	0.0014014	0	0	0.00000	0.10170
R-113	0	0	0	0	0	0.00000	0.00000
Acetaldehyde					0	0.00000	0.00000
Acrolein					0	0.00000	0.00000
Benzene	9.70974E-05	2.21161E-06	1.3377E-06	0	0	0.00000	0.00010
1,3-Butadiene					0	0.00000	0.00000
2-Butanone					0	0.00000	0.00000
Chloroform					0	0.00000	0.00000
Chloromethane					0	0.00000	0.00000
1,1-Dichloroethene					0	0.00000	0.00000
Ethylbenzene	1.1135E-08	2.76887E-07	0	0	0	0.00000	0.00000
Ethylene Glycol					0	0.00000	0.00000
Formaldehyde	0.003477105	0.00031128	0.000047775	0	0	0.00000	0.00348
Hexane	0.083198965	0.001215587	0.0011466	0	0	0.00000	0.08320
Methylene Chloride	0	0	0	0	0	0.00000	0.00000
Naphthalene	2.83914E-05	5.29133E-06	3.8857E-07	0	0	0.00000	0.00003
Phenol	0	0	0	0	0	0.00000	0.00000
Propionaldehyde	0	0	0	0	0	0.00000	0.00000
Styrene	0	0	0	0	0	0.00000	0.00000
Tetrachloroethylene	0	0	0	0	0	0.00000	0.00000
Toluene	0.00015823	2.90644E-05	2.1658E-06	0	0	0.00000	0.00016
1,1,1 Trichloroethane	4.13184E-08	1.02744E-06	0	0	0	0.00000	0.00000
Trichloroethylene	0	0	0	0	0	0.00000	0.00000
Vinyl Chloride	0	0	0	0	0	0.00000	0.00000
o-Xylene	1.90835E-08	4.74539E-07	0	0	0	0.00000	0.00000
As	9.80436E-08	0.000002438	0	0	0	0.00000	0.00000
Be	5.09144E-05	2.49895E-06	7.007E-07	0	0	0.00000	0.00005
Cd	3.95593E-06	1.8797E-06	5.3508E-08	0	0	0.00000	0.00000
Co	6.47066E-05	8.533E-07	8.918E-07	0	0	0.00000	0.00006
Cr	6.47801E-05	2.6818E-06	8.918E-07	0	0	0.00000	0.00006
Hg	1.20905E-05	1.98697E-06	1.6562E-07	0	0	0.00000	0.00001
Mn	1.77103E-05	3.88861E-06	2.4206E-07	0	0	0.00000	0.00002
Ni	9.71334E-05	3.10845E-06	1.3377E-06	0	0	0.00000	0.00010
Pb	2.33301E-05	5.79025E-06	3.185E-07	0	0	0.00000	0.00002
POM	2.9719E-06	1.43984E-05	3.29966E-08	0	0	0.00000	0.00001
Se	0	0	0	0	0	0.00000	0.00000
Total HAPs	0.087297551	0.001604738	0.001202902	0	0	0.00000	0.08730

Table F-1: (continued)							
Description	SL2/SL3 Test Facility, #56	SL2/SL3 Test Facility, #56	SL2/SL3 Test Facility, #56	SL2/SL3 Test Facility, #56	SL2/SL3 Test Facility, #56	SL2/SL3 Test Facility, #56	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	0.103660076	130.301021	84.39720334	39.14467436	48.89185962	0.10366	130.30102
NOx	0.056952269	71.58916967	46.36898209	21.50662145	26.86185884	0.05695	71.58917
PM	0.004992468	6.275547364	4.064731364	1.885282679	2.354725836	0.00499	6.27555
SOx	0.006261305	7.870478783	5.097783525	2.364427589	2.953179804	0.00626	7.87048
VOC	0.017802899	22.37829604	14.49463394	6.722826147	8.396837567	0.01780	22.37830
VOC HAP	0.005301703	6.66425656	4.316501986	2.002057626	2.500578227	0.00530	6.66426
TSP HAP	8.53712E-05	0.10731186	0.069506906	0.032238334	0.040265812	0.00009	0.10731
CH4	0	0	0	0	0	0.00000	0.00000
CO2	0	0	0	0	0	0.00000	0.00000
NH3	0	0	0	0	0	0.00000	0.00000
N2O	0	0	0	0	0	0.00000	0.00000
R-113	0	0	0	0	0	0.00000	0.00000
Acetaldehyde	0.00085988	1.080871699	0.700090819	0.324712503	0.405567254	0.00086	1.08087
Acrolein	0.000423709	0.532603446	0.344972288	0.160003262	0.199844734	0.00042	0.53260
Benzene	0.000359619	0.45204158	0.292791606	0.135801088	0.169616119	0.00036	0.45204
1,3-Butadiene	0.000336475	0.422949795	0.273948581	0.127061414	0.15870023	0.00034	0.42295
2-Butanone					0	0.00000	0.00000
Chloroform					0	0.00000	0.00000
Chloromethane					0	0.00000	0.00000
1,1-Dichloroethene					0	0.00000	0.00000
Ethylbenzene	3.20452E-05	0.040280933	0.026090341	0.012101087	0.015114308	0.00003	0.04028
Ethylene Glycol					0	0.00000	0.00000
Formaldehyde	0.002755889	3.464160227	2.243769333	1.040693487	1.299830455	0.00276	3.46416
Hexane	0	0	0	0	0	0.00000	0.00000
Methylene Chloride	0	0	0	0	0	0.00000	0.00000
Naphthalene	0.000106817	0.134269776	0.086967804	0.040336957	0.050381025	0.00011	0.13427
Phenol	4.62875E-05	0.05818357	0.037686048	0.017479348	0.021831778	0.00005	0.05818
Propionaldehyde	0.000174468	0.219307301	0.142047413	0.065883696	0.082289008	0.00017	0.21931
Styrene	7.29919E-05	0.091751014	0.059427999	0.027563587	0.034427034	0.00007	0.09175
Tetrachloroethylene	0	0	0	0	0	0.00000	0.00000
Toluene	9.79159E-05	0.123080628	0.079720487	0.036975544	0.046182607	0.00010	0.12308
1,1,1 Trichloroethane	0	0	0	0	0	0.00000	0.00000
Trichloroethylene	0	0	0	0	0	0.00000	0.00000
Vinyl Chloride	0	0	0	0	0	0.00000	0.00000
o-Xylene	3.56058E-05	0.044756592	0.028989268	0.013445652	0.016793675	0.00004	0.04476
As	2.64601E-05	0.033260401	0.021543076	0.009991998	0.012480047	0.00003	0.03326
Be	0	0	0	0	0	0.00000	0.00000
Cd	2.49623E-06	0.003137774	0.002032366	0.000942641	0.001177363	0.00000	0.00314
Co	0	0	0	0	0	0.00000	0.00000
Cr	2.64601E-05	0.033260401	0.021543076	0.009991998	0.012480047	0.00003	0.03326
Hg	0	0	0	0	0	0.00000	0.00000
Mn	0	0	0	0	0	0.00000	0.00000
Ni	0	0	0	0	0	0.00000	0.00000
Pb	2.74586E-05	0.034515511	0.022356023	0.010369055	0.012950992	0.00003	0.03452
POM	0	0	0	0	0	0.00000	0.00000
Se	2.49623E-06	0.003137774	0.002032366	0.000942641	0.001177363	0.00000	0.00314
Total HAPs	0.005387074	6.77156842	4.386008892	2.03429596	2.540844039	0.00539	6.77157

Table F-1: (continued)							
Description	AC&T Air Stripper, #67	AC&T Air Stripper, #67	AC&T Air Stripper, #67	AC&T Air Stripper, #67	AC&T Air Stripper, #67	AC&T Air Stripper, #67	
	2000	2001	2002	2003	2004	Minimum	Maximum
CO	0	0	0	0	0	0.00000	0.00000
NOx	0	0	0	0	0	0.00000	0.00000
PM	0	0	0	0	0	0.00000	0.00000
SOx	0	0	0	0	0	0.00000	0.00000
VOC	0.001209	0.001209	0.001209	0.001209	0.004533231	0.00121	0.00453
VOC HAP	0.000112384	0.000112384	0.000112384	0.000112384	0.002005234	0.00011	0.00201
TSP HAP	0	0	0	0	0	0.00000	0.00000
CH4	0	0	0	0	0	0.00000	0.00000
CO2	0	0	0	0	0	0.00000	0.00000
NH3	0	0	0	0	0	0.00000	0.00000
N2O	0	0	0	0	0	0.00000	0.00000
R-113	0	0	0	0	0	0.00000	0.00000
Acetaldehyde					0	0.00000	0.00000
Acrolein					0	0.00000	0.00000
Benzene					0	0.00000	0.00000
1,3-Butadiene					0	0.00000	0.00000
2-Butanone					0	0.00000	0.00000
Chloroform					1.78839E-06	0.00000	0.00000
Chloromethane					1.73522E-05	0.00002	0.00002
1,1-Dichloroethene					0	0.00000	0.00000
Ethylbenzene					0	0.00000	0.00000
Ethylene Glycol					0	0.00000	0.00000
Formaldehyde	0	0	0	0	0	0.00000	0.00000
Hexane	0	0	0	0	0	0.00000	0.00000
Methylene Chloride	0	0	0	0	0	0.00000	0.00000
Naphthalene	0	0	0	0	0	0.00000	0.00000
Phenol	0	0	0	0	0	0.00000	0.00000
Propionaldehyde	0	0	0	0	0	0.00000	0.00000
Styrene	0	0	0	0	0	0.00000	0.00000
Tetrachloroethylene	0	0	0	0	0	0.00000	0.00000
Toluene	0	0	0	0	0	0.00000	0.00000
1,1,1 Trichloroethane	0	0	0	0	0	0.00000	0.00000
Trichloroethylene	5.0276E-05	5.0276E-05	5.0276E-05	5.0276E-05	0.001694301	0.00005	0.00169
Vinyl Chloride	2.36689E-05	2.36689E-05	2.36689E-05	2.36689E-05	0.000291793	0.00002	0.00029
o-Xylene	0	0	0	0	0	0.00000	0.00000
As	0	0	0	0	0	0.00000	0.00000
Be	0	0	0	0	0	0.00000	0.00000
Cd	0	0	0	0	0	0.00000	0.00000
Co	0	0	0	0	0	0.00000	0.00000
Cr	0	0	0	0	0	0.00000	0.00000
Hg	0	0	0	0	0	0.00000	0.00000
Mn	0	0	0	0	0	0.00000	0.00000
Ni	0	0	0	0	0	0.00000	0.00000
Pb	0	0	0	0	0	0.00000	0.00000
POM	0	0	0	0	0	0.00000	0.00000
Se	0	0	0	0	0	0.00000	0.00000
Total HAPs	7.39449E-05	7.39449E-05	7.39449E-05	7.39449E-05	0.002005234	0.00007	0.00201

Table F-1: (continued)			
Description	2000 Total Actual	2001 Total Actual	2002 Total Actual
	2000	2001	2002
CO	156.62050	170.03019	121.88795
NOx	122.46455	122.88506	88.56680
PM	10.58259	9.30800	6.74820
SOx	33.75674	9.94296	6.89031
VOC	4.13350	25.08911	16.80066
VOC HAP	1.38986	8.02542	5.10178
TSP HAP	0.25021	0.11170	0.07230
CH4	11.83092	0.76626	0.69947
CO2	80077.97931	22219.57883	11860.50752
NH3	1.54481	1.05645	0.96574
N2O	1.95088	0.74097	0.67525
R-113	0.13166	0.13166	0.13166
Acetaldehyde	0.03603	1.10916	0.71716
Acrolein	0.01775	0.54654	0.35338
Benzene	0.24037	0.46562	0.30059
1,3-Butadiene	0.01410	0.43402	0.28063
2-Butanone			
Chloroform			
Chloromethane			
1,1-Dichloroethene			
Ethylbenzene	0.00140	0.04134	0.02673
Ethylene Glycol	0.31903	0.45119	0.00000
Formaldehyde	0.34201	3.58834	2.32737
Hexane	0.76560	0.59731	0.54602
Methylene Chloride	0.00000	0.00000	0.00000
Naphthalene	0.00560	0.13813	0.08939
Phenol	0.00194	0.05971	0.03860
Propionaldehyde	0.00731	0.22505	0.14551
Styrene	0.00306	0.09415	0.06088
Tetrachloroethylene	0.00000	0.01344	0.00000
Toluene	0.01070	0.12825	0.08333
1,1,1 Trichloroethane	0.00022	0.00003	0.00002
Trichloroethylene	0.04151	0.04151	0.04151
Vinyl Chloride	0.05655	0.05655	0.05655
o-Xylene	0.00158	0.04594	0.02971
As	0.00277	0.03384	0.02193
Be	0.00040	0.00006	0.00004
Cd	0.00097	0.00360	0.00243
Co	0.00010	0.00003	0.00003
Cr	0.00316	0.03422	0.02228
Hg	0.00571	0.00017	0.00012
Mn	0.00086	0.00024	0.00020
Ni	0.00122	0.00075	0.00068
Pb	0.00358	0.03531	0.02291
POM	0.00278	0.00046	0.00035
Se	0.00197	0.00345	0.00227
Total HAPs	1.88827	8.14839	5.17063

Table F-1: (continued)

Footnotes:

The following constituents were not detected in any year evaluated: H_2S,H_2,R-12, R-22,
H-134A, Cumene, Cyanide, 1,2,4 Trichlorobenzene,1,1,2 Trichloroethane, 2,2,4-Trimethyl pentane, m-Xylene, p-Xylene, Xylenes, HCl
CO = Carbon Monoxide
NO_x = Nitrogen Oxides
PM = Particulate Matter
SO_x = Sulfur Oxides
VOC = Volatile Organic Compound
HAP = Hazardous Air Pollutant
TSP =
CH_4 = Carbon Tetrachloride
CO_2 = Carbon Dioxide
NH_3 = Ammonia
N2O
R-113
As = Arsenic
Be = Beryllium
Cd = Cadmium
Co = Cobalt
Cr = Chromium
Hg = Mercury
Mn = Manganese
Ni = Nickel
Pb = Lead
POM
Se = Selenium

APPENDIX G

List of Hazardous Materials Used at AEDC as of September 2005

Table G-1: Hazardous Materials Onsite 29 September 2005

Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
ADHESIVE REMOVER	08908/3M WOODGRAIN AND STRIPE ADHESIVE REMOVER	182012	6	16	OZN
AEROSOL PRIMER, LIGHT GRAY	0234-382 / A-A-1551A, LIGHT GRAY SO-SURE AEROSOL PRIMER	182258	2	12	OZN
"A" SERIES-ALL SHADES	MINWAX (R) WOODFINISH	179063	1	1	GL
"A" SERIES-ALL SHADES	MINWAX (R) WOODFINISH	179165	1	0.5	PT
(R)-(+)-LIMONENE, 97%	PRODUCT # 18316-4	148679	1	5	ML
00708 T.F.E. DRY LUBE	00708 T.F.E. DRY LUBE	14610	3	10	OZF
00900 GRAY PRIMER	00900 GRAY PRIMER	14684	3	12	OZF
00901 CLEAN N' SAFE	CLEAN N' SAFE 00901 FLAT WHITE	14682	1	0.4	KG
00901 CLEAN N' SAFE	CLEAN N' SAFE 00901 FLAT WHITE	14682	5	12	OZF
00902 CLEAN N' SAFE	CLEAN N' SAFE 00902 FLAT BLACK	147682	8	0.43	KG
00902 CLEAN N' SAFE	CLEAN N' SAFE 00902 FLAT BLACK	147682	7	12	OZF
00902 CLEAN N' SAFE	CLEAN N' SAFE 00902 FLAT BLACK	147682	1	12	OZN
00904 CLEAN N' SAFE	CLEAN N' SAFE 00904 YELLOW	147694	3	12	OZF
00905 CLEAN N' SAFE	CLEAN N' SAFE 00905 BLUE	147704	5	12	OZF
00906 CLEAN N' SAFE	CLEAN N' SAFE 00906 GREEN	147709	1	12	OZF
00913 CLEAN N' SAFE	CLEAN N' SAFE 00913 GLOSS WHITE	147720	17	12	OZF
00914 CLEAN N' SAFE	CLEAN N' SAFE 00914 GLOSS BLACK	147725	1	12	OZF
02001 ELEC CLNR & LUBRI SPRAY	02001 ELEC CLNR & LUBRI SPRAY	14552	1	16	OZF
0530 CHROME ALUMINUM	SUPERACRYLIC CONTROLS RUST SPRAY ENAMEL (12 OZ CAN)	49786	1	0.2	KG
1,1,2-TRICHLOROTRIFLUOROETHANE SOLUTION	HC-480	180979	3	8	ML
1,2,3-TRICHLOROPROPANE	47669-U	181034	6	5	MG
1-BUTANOL	1-BUTANOL	178617	1	1	LR
1-PROPANOL	293288	180658	1	500	ML
1/16" TO 1/2" BLUE GRANULES	INDICATING DRIERITE	178847	11	1	LB
1200 RTV PRIME COAT, RED	1200 RTV PRIME COAT, RED	182037	1	1	GL
1201 RTV PRIME COAT	1201 RTV PRIME COAT	182040	1	1	GL
155002 ALGAEOX	155002 ALGAEOX	182111	1	400	LB
2-BROMOPROPIONIC ACID	47645	181040	1	4	MG
2-BROMOPROPIONIC ACID	47645	181040	5	5	MG
2-PACKAGE EPOXY COATING	B58 T 104 ULTRADEEP BASE	178600	1	1	GL
2-PROPANOL	A-416 2-PROPANOL	14631	17	1	GL
2-PROPANOL	A520-4	179711	1	4	LR
2-PROPANOL	P6401-05	179060	1	30	ML
20000 GLOSS WHITE	20000 GLOSS WHITE	181777	3	6	CC
20000 GLOSS WHITE	20000 GLOSS WHITE	181777	3	6	OZN
20000 GLOSS WHITE	20000 GLOSS WHITE	181777	7	12	OZN
21309	CAN500 QT N/REB 5 GR	181688	9	0.18	OZF
21309	CAN500 QT N/REB 5 GR	181688	24	2	OZF
215 FIBERED ALUMINUM ROOF COATING	214 NON-FIBERED ALUMINUM ROOF COATING	147808	6	5	GL
242 THREADLOCKER	LOCTITE (R) 242 (R) THREADLOCKER MEDIUM STRENGTH 242631	181731	34	50	ML
242 THREADLOCKER	LOCTITE (R) 242 (R) THREADLOCKER MEDIUM STRENGTH 242631	181778	19	50	ML
25% CARBON DIOXIDE 75% ARGON	STARGOLD C-25 SHIELDING GAS MIXTURE	180339	19	278	CF
268 THREADLOCKER STICK	37686	181849	5	0.67	OZN
277 THREADLOCKER	277 LOCTITE THREADLOCKER	181950	15	50	ML
30795, 30782	OATEY CLEANER - 005	148399	58	8	OZF
32007, 32007-5XX, & 32107 / AROCLOR 1221 MIX	32007, 32007-5XX, & 32107 / AROCLOR 1221 MIX	182068	1	5	GM
32008, 32008-5XX, & 32108 / AROCLOR 1232 MIX	32008, 32008-5XX, & 32108 / AROCLOR 1232 MIX	182070	1	5	GM
32012, 32012-5XX, & 32112 / AROCLOR 1260 MIX	32012, 32012-5XX, & 32112 / AROCLOR 1260 MIX	182069	2	5	GM
37 11A33R READY MIXED ALUMINUM	37 11A33R READY MIXED ALUMINUM	15197	2	5	GL
3M FAST TACK TRIM ADHESIVE	3M FAST TACK TRIM ADHESIVE 08031	14659	2	12	OZN
3M STAINLESS STEEL CLEANER AND POLISH	3M STAINLESS STEEL CLEANER AND POLISH	181716	1	1	GL
3M STAINLESS STEEL CLEANER AND POLISH	3M STAINLESS STEEL CLEANER AND POLISH	181865	12	20.5	OZN
3M SUPER 77	3M SUPER 77	15261	1	17	OZF
3M SUPER FAST URETHANE (BLACK)	08609	179824	3	10	OZF
3M SUPER FAST URETHANE - BLACK	08609	179493	50	11	OZF
3M WINDO-WELD RESEALANT	08633	181984	1	1	PT
404 QUICK SET INSTANT ADHESIVE	46551 CYANOACRYLATE	182121	7	0.333	OZN
420 SUPER BONDER INSTANT ADHESIVE	42050	181851	6	0.67	OZN

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
426 PRISM BLACK MAX GEL INSTANT ADHESIVE	18398/426 PRISM BLACK MAX GEL INSTANT ADHESIVE	182034	2	7	OZN
495 SUPER BONDER INSTANT ADHESIVE	49504 CYANOACRYLATE	182120	3	3	GM
59204	59000 ENAMEL PLUS GLOSS SCREEN INK	148441	2	1	QT
60-RAM TR	60-RAM TR	182049	2	55	LB
652 PNEUMATIC LUBRICANT & CONDITIONER	MSDS NO. 289	178944	1	16	OZF
652 PNEUMATIC LUBRICANT & CONDITIONER	MSDS NO. 289	180441	3	16	OZF
660 QUICK METAL (R) RETAINING COMPOUND	66040	181620	1	50	ML
80017, -19	AVIATION FORM-A-GASKET #3	14574	4	8	OZF
80017, -19	AVIATION FORM-A-GASKET #3	14574	3	16	OZF
A-1 KIT	A-1 KIT	14566	1	0.21	KG
ACADEMY SILVER RECOVERY AGENT (PART B)	867-1588	180997	1	500	ML
ACADEMY SILVER RECOVERY SOLUTION (PART A)	PTA55; PTA15; PTAKIT	180996	4	15	GL
ACETONE	ACETONE	14626	6	1	GL
ACETONE	ACETONE	14640	22	1	GL
ACETONE	ACETONE	147940	8	0.13	GL
ACETONE	ACETONE	147940	41	1	GL
ACETONE	ACETONE	147940	66	1	PT
ACETONE	ACETONE	147940	1	2	GL
ACETONE	ACETONE	147940	1	3.925	GL
ACETONE	ACETONE	147940	4	4	LR
ACETONE	ACETONE	147940	1	13	OZF
ACETONE	ACETONE	147940	4	16	OZF
ACETONE	ACETONE	147940	1	55	GL
ACETONE	AX0110, AX0116, AX0118, AX0120, AX0120S	148295	1	1	LR
ACETONE	AX0116	180315	3	4	LR
ACETONE	REAGENT ACETONE	147831	1	0.09	GL
ACETONE	REAGENT ACETONE	147831	7	0.13	GL
ACETONE	REAGENT ACETONE	147831	17	1	GL
ACETONE	REAGENT ACETONE	147831	1	4	LR
ACETONE SOLUTION AT 5000 PG/ML IN METHANOL	EPA-1001	180902	4	1	LR
ACETONE SOLUTION AT 5000 PG/ML IN METHANOL	EPA-1001	180902	1	4	MG
ACETONITRILE	AX0142	180312	7	1	LR
ACETONITRILE	AX0155-1	181171	4	1	LR
ACETONITRILE	AX142-1	180016	1	4	LR
ACETYLENE	ACETYLENE	180334	7	1	CF
ACETYLENE	ACETYLENE	180334	58	10	CF
ACETYLENE	ACETYLENE	180336	210	225	CF
ACETYLENE	ACETYLENE, TECHNICAL, GRADE B, DISSOLVED	15174	27	10	CF
ACETYLENE, TECHNICAL, GRADE B, DISSOLVED	ACETYLENE	14976	68	225	CF
ACETYLENE, TECHNICAL, GRADE B, DISSOLVED	ACETYLENE	103887	2	225	CF
ACID	E-Z MURIATIC ACID	179989	2	1	GL
ACID	OLEIC ACID	182268	1	500	ML
ACID DETERGENT	AD-20 MEMBRANE CLEANER	182375	3	100	LB
ACID DETERGENT CLEANER	OSMO AD-20	181226	3	45	LB
ACIDIC AQUEOUS SOLUTION	CC-540	180290	1	5	GL
ACIDIC CLEANER	WHITEY TILE & GROUT CLEANER	179652	53	32	OZF
ACRI-SHIELD ACRYLIC BONDING PRIMER	515	181289	1	1	GL
ACRYLIC EMULSION ADHESIVE	630 HENRY PEACH GLUE SPECIAL PURPOSE FLOOR COVERING ADHESIVE	148631	3	1	GL
ACRYLIC GLOSS SAFETY RED	B66R38 SAFETY RED	14689	1	1	GL
ACRYLIC GLOSS SAFETY YELLOW	B66Y37 SAFETY YELLOW	14688	12	1	GL
ACRYLIC LATEX CAULK (FOR COMPLETE MSDS CALL 7380/4788	C-850	179789	44	10	OZF
ACRYLIC LATEX CAULK - WHITE	C 1050	15329	1	10.5	OZF
ACRYLIC PAINT	79-110 MANOR HALL EXTERIOR PASTEL	182272	12	1	GL
ACS TOLUENE	T324-4	179724	2	4	LR
ACTIVATED ALUMINA	ACTIVATED ALUMINA	181987	2	50	LB
ACTIVATOR/EPOXY	9101402/HIGH PERFORMANCE EPOXY STANDARD	182364	8	1	GL
ACTIVE ODOR REMOVER	071012	179649	36	32	OZF
ADHESION PROMOTER - RED	P5200 ADHESION PROMOTER - RED	182050	1	1	QT
ADHESIVE	01-06756 / LOCTITE EXTERIOR POWER GRAB	182292	3	10	OZF

Table G-1: (continued)

Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
ADHESIVE	0534-000/SO-SURE RUBBER ADHESIVE	182251	1	24	OZF
ADHESIVE	08011/3M(TM) WEATHERSTRIP ADHESIVE- BLACK	182125	4	10	OZN
ADHESIVE	250 SOUTHLAND SOLVENT	179641	1	1	GL
ADHESIVE	3M SUPER 74 FOAM FAST ADHESIVE	181533	8	16	OZF
ADHESIVE	3M SUPER 77 SRPAY ADHESIVE	180010	1	16.5	OZF
ADHESIVE	3M SUPER 77 SRPAY ADHESIVE	180010	42	24	OZF
ADHESIVE	3M SUPER WEATHERSTRIP AND GASKET ADHESIVE 08001	91053	1	5	OZN
ADHESIVE	440 COVE BASE ADHESIVE	181510	2	29	OZF
ADHESIVE	440 COVE BASE ADHESIVE	181510	2	3029	OZF
ADHESIVE	45401 DAP BEATS THE NAIL - TROWELABLE	181496	6	10.5	OZF
ADHESIVE	46548/QUICK SET 404 INDUSTRIAL ADHESIVE	181905	8	4	OZN
ADHESIVE	4910/INSTANT ADHESIVE	182093	1	1	OZN
ADHESIVE	520 ADHESIVE	178856	4	1	GL
ADHESIVE	57004920/GAPPER ADHESIVE	182089	1	1	OZN
ADHESIVE	57060100/FLEXMASTER UV ADHESANT	182091	1	3.7	OZN
ADHESIVE	906/ MAGNESIA CERAMIC ADHESIVE	181944	1	1	PT
ADHESIVE	AHE90124TNO/ LIQUID NAILS HEAVY DUTY ADHESIVE	182078	3	10.5	OZN
ADHESIVE	BLAX MAX 380 TOUGH INSTAND ADHESIVE	181182	1	1	OZF
ADHESIVE	DURABOND 950-1	181612	1	16	OZF
ADHESIVE	EA 956 SYSTEM PART A	179707	1	12.5	GM
ADHESIVE	EA 956 SYSTEM PART B	179708	1	12.5	GM
ADHESIVE	HENRY 416 WOOD PARAQUET ADHESIVE	179262	15	1	GL
ADHESIVE	HYSOL EA 921NA PART A	178627	3	1	QT
ADHESIVE	HYSOL EA 921NA PART B	178628	2	8	OZF
ADHESIVE	HYSOL EA 9330 (PART B)	180942	2	1	QT
ADHESIVE	LN-602	148817	2	29	OZF
ADHESIVE	LORD 402 (PART A) MSDS FOR P/B IS 181056	181055	10	25	MG
ADHESIVE	M BOND 610 ADHESIVE	181906	1	3	OZF
ADHESIVE	M-BOND 610 ADHESIVE	180683	1	8	OZF
ADHESIVE	RITE-LOK TL42-10	180434	383	10	CC
ADHESIVE	RTV 159;SILICONE SEALANT	93000	139	3	OZF
ADHESIVE	RTV 159;SILICONE SEALANT	93000	34	48	OZF
ADHESIVE	SUPERBONDER 420	181856	11	1	OZN
ADHESIVE ACCELERATOR	01899300/ADHESIVE ACCELERATOR	182092	1	2	OZF
ADHESIVE ANCHOR SYSTEM	HVU	180640	6	2.5	OZN
ADHESIVE CAULK	ENVIROLINE BEATS THE NAIL ADHESIVE CAULK	181909	16	10.3	OZN
ADHESIVE MULTI-PURPOSE 3M P/N 847	SCOTCH-GRIP (TM) 847 RUBBER & GASKET ADHES	108533	1	1	QT
ADHESIVE MULTI-PURPOSE 3M P/N 847	SCOTCH-GRIP (TM) 847 RUBBER & GASKET ADHES	108533	6	5	OZN
ADHESIVE PARTS A&B	940 ZIRCONIA CERAMIC ADHESIVE	181613	1	1	QT
ADHESIVE PARTS A&B	940 ZIRCONIA CERAMIC ADHESIVE	181613	2	32	OZF
ADHESIVE REMOVER	SAF-T-LOK DEBOND	181735	1	1	PT
ADHESIVE, ACCELERATOR	ZIP KICKER ACCELERATOR FOR SUPER GLUES	182270	4	2	OZN
ADHESIVE, FLOOR TILE, MUTLI-PURPOSE	HENRY 430	181454	1	1	GL
ADHESIVE, INDUSTRIAL, SCOTCH GRIP	4475	181340	3	5	OZN
ADHESIVE, QUICK SETTING	ZAP CA	182271	4	1	OZN
ADHESIVE/SEALANT-GRAY	DOW CORNING 3145 RTV	181747	2	13.5	OZF
ADJUVANT	603562 / APSA-80 ALL PURPOSE SPRAY ADJUVANT CONCENTRATE	182199	1	2.5	GL
ADOX	ADOX 750/SODIUM CHLORITE SOLUTION IN WATER	181939	9	275	GL
ADVANTAGE 900 INTERIOR/EXTERIOR LATEX, DOVER WHITE	919/ADVANTAGE 900 INTERIOR/EXTERIOR LATEX	182024	4	1	GL
ADVANTAGE 900 INTERIOR/EXTERIOR LATEX, WHITE OLIVE	919/ADVANTAGE 900 INTERIOR/EXTERIOR LATEX	182023	5	1	GL
AEROKROIL	AEROKROIL	148189	717	10	OZF
AEROSHELL PERFORMANCE ADDITIVE 101	8Q462	181534	3	280	GL
AEROSOL	212 PURPLE PRIMER 91202	182217	1	8	OZF
AEROSOL	PYROIL REGULAR STARTING FLUID 12/11 OZ	182202	1	11	OZF
AEROSOL ACCELERATOR	21348/LOCQUIC(R) PRIMER N 7649	182020	1	1.69	OZF
AEROSOL ACCELERATOR	22761 / DEPEND ACTIVATOR	181840	3	4.5	ML
AEROSOL ADHESIVE	08090/3M BRAND SUPER TRIM ADHESIVE	182028	2	19	OZN
AEROSOL ALKYD RESIN	1017097-01 / CLUB CAR BEIGE LACQUER	182206	2	13	OZF
AEROSOL BELT CONDITIONER	80074 / 120GA BELT DRESSING AND CONDITIONER 5 OZ	182204	3	5	OZF
AEROSOL BLUE	80000	180379	2	12	OZF
AEROSOL BLUE	80000	180379	29	13	OZF
AEROSOL CARPET SPOTTER	PILE DRIVER	180946	13	18	OZF
AEROSOL CLEANER	30521/PRO STRENGTH DEGREASER	181885	6	15	OZN
AEROSOL DUSTER	07605-AB/TWO-IN-ONE OK EASY DUSTER	181935	39	11	OZN
AEROSOL ELECTRIC CONTACT CLEANER	0072 / ZEP ELEC II AEROSOL	181961	17	20	OZF
AEROSOL FLUX REMOVER	4140-AEROSOL / FLUX REMOVER	182212	2	14	OZN

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
AEROSOL HAND PROTECTANT	69739 / INVISI BARRIER	182207	8	18	OZF
AEROSOL LUBRICANT	S00607 / SPRAYON BELT DRESSING	182201	1	13	OZF
AEROSOL MARKING PAINT	2324/2333/2344/2345/2354/2363/2392/5H911/5H912/5H913/5H914/	148216	9	9	OZF
AEROSOL PAINT	RDG0110 / RED DEVIL INT/EXT HIGH GLOSS ENAMEL, ALUMINUM	182200	2	11	OZF
AEROSOL PAINT, BLACK	1618/KRYLON BBQ AND STOVE PAINT, BLACK	182038	4	16	OZF
AEROSOL SPRAY ADHESIVE	CAMIE 397 HDLNR, TRIM, LAM ADH	181817	2	14	OZF
AEROSOL SPRAY ADHESIVE	CAMIE 397 HDLNR, TRIM, LAM ADH	181817	3	16.5	OZF
AEROSOL SPRAY COATING	KRYLON 1307 BATTERY PROTECTOR	155615	13	16	OZF
AEROSOL SPRAY COATING	KRYLON 1307 BATTERY PROTECTOR	179065	11	11	OZF
AEROSOL, GENERAL PURPOSE, FLAT BLACK 37038	SO SURE LACQUER,FLAT BLACK 37038,14B390 G/O	113877	1	1	PT
AEROSOL, LACQUER, BLACK 17038 GLOSSY	SO-SURE GLOSS BLACK 17038(14B190)(G/0) LACQ	181298	18	16	OZF
AEROSOL, LACQUER, BLACK 17038 GLOSSY	SO-SURE GLOSS BLACK 17038(14B190)(G/0) LACQ	181642	4	16	OZF
AGRICULTURAL LIMESTONE	N/A	181834	23	40	LB
AIR	AIR	179925	2	20	LB
AIR	AIR	181463	4	150	CF
AIR BRAKE SYSTEM ANTI-FREEZE AND RUST GUARD	M28-32, -34,-49 ANTI-FREEZE AND RUST GUARD	179005	1	32	OZF
AIR BRAKE SYSTEM ANTIFREEZE	AIR BRAKE SYSTEM ANTIFREEZE	181262	14	32	OZF
AIR DRY ENAMEL	1201	15325	1	1	QT
AIR DRY ENAMEL	1201	181261	4	1	QT
ALGAECIDE	JUNCTION	182288	2	6	LB
ALKALINE CYANIDE SOLUTION	21223	180421	2	500	ML
ALKALINE CYANIDE SOLUTION	ORDER #833381	148158	1	500	ML
ALKYD ENAMEL PAINT	2750/PORTER GUARD FAST DRY ALKYD ENAMEL	181880	35	1	GL
ALKYD FLAT B34W401 BASE X	PROMAR 400 SEMI GLOSS	14717	28	1	GL
ALKYD FLAT, SEMI-GLOSS & EG-SHEL FINISHES	B33 W 201 PURE WHITE	148250	16	1	GL
ALL COLORS & CLEAR	H&C SILICONE ACRYLIC CONCRETE STAIN	179818	1	1	GL
ALL PURPOSE LUBRICANT	M.1 OIL	180199	7	12	OZF
ALL SOL FLUX	E 100 ALL SOL FLUX	148007	1	16	OZF
ALLOY 93	FLUOROWAY	179423	2	4	OZF
ALTOSID BRIQUETS	ZOECON ALTOSID BRIQUETS	181980	1	1	LB
ALUMINUM	S01760	179998	17	12	OZF
ALUMINUM CLEANER	757801 / LIQUID NEGGATE	182159	6	1	GL
ALUMINUM OXIDE FILLED TWO COMPONENT EPOXY SYSTEM	TCE-002/TCE-003	181324	41	5	GM
AMERISTRIP GEL	AMERISTRIP GEL	179001	1	9	OZF
AMMONIA CYLINDER FOR DUPLIPRINTER	CZ-0000-0023-0, 78-8004-6017-8	178780	1	2	LB
AMMONIUM CHLORIDE	1143	179815	1	50	GM
ANAEROBIC	37684 / 248 MEDIUM STRENGTH THREADLOCKER STICK	182326	19	2	OZN
ANAEROBIC	37685 / 268 HIGH STRENGTH THREADLOCKER STICK	182327	20	2	OZN
ANAEROBIC SEALANT	26221	181822	1	10	ML
ANAEROBIC ADHESIVE	27285 / 272 THREADLOCKER HIGH STR/HIGH TEMP	182285	30	50	ML
ANAEROBIC GASKET	51031 / 50ML GASKET ELIMINATOR 510	182283	30	50	ML
ANAEROBIC SEALANT	24077 / LOCTITE(R) THREADLOCKER 243 MEDIUM STRENGTH	182282	30	10	ML
ANAEROBIC THREAD SEALANT	SWAK	140548	4	16	OZF
ANAEROBIC THREADLOCKER	24221 THREADLOCKER	15098	1	0.015	KG
ANAEROBIC THREADLOCKER	24221 THREADLOCKER	181078	33	10	ML
ANALYTICAL STANDARD IN METHANOL	47385	179891	3	2000	ML
ANCHORLUBE G-771	ANCHORLUBE G-771	14593	13	32	OZF
ANEROBIC ADHESIVE	62040/LOCTITE 620 RETAINING COMPOUND	181923	2	50	ML
ANT KILLER BAIT	MAXFORCE FX ANT KILLER BAIT GEL RESERVOIRS	181568	4	3.8	OZN
ANT KILLER BAIT STATIONS	MAXFORCE ANT KILLER BAIT STATIONS	181971	9	2	LB
ANTI-FREEZE, ETHYLENE GLYCOL BASE	PERMANENT ANTI-FREEZE -500 X L ANTI FREEZE	147866	2	55	GL
ANTI-STATIC SPRAY	32N1079 SPRAYTEC ANTI-STATIC SPRAY (12-3/4 OZ)	150809	1	12.75	OZF
ANTIFREEZE	7994 TEXACO HAVOLINE DEX-COOL	180804	13	1	GL
ANTISEIZE COMPOUND	LEAD-FREE ANTI-SEIZE LUBRICANT	101251	1	0.56	KG
ANTISEIZE LUBRICANT	51007/C5A COPPER BASE ANTISEIZE	181897	2	16	OZN
AQUACLEAN	AQUACLEAN	181311	12	55	GL
AQUEOUS ACRYLIC EMULSION	FLEX-CON	182005	2	1	GL
AQUEOUS ALKALINE SOLUTION	CCS-10	179457	4	5	GL
AQUEOUS DEGREASER	HARVEY'S INDUSTRIAL DEGREASER	178750	1	1	QT
ARGON	ARGON	15006	3	2491	CF
ARGON	ARGON	180333	413	249	CF
ARGON/CARBON DIOXIDEGAS BLEND	ARGON/CARBON DIOXIDE GAS BLEND	181922	11	300	CF
AROCLOR 1016	AROCLOR 1016 MIX VWR # 32006, 32006-5XX & 32106	181548	1	5	ML

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
AROCLOR 1016/1260	32039, 32039-5XX & 32139 / AROCLOR 1016/1260	181556	1	2500	ML
AROCLOR 1242 MIX	32009, 32009-5XX, & 32109	180729	1	5	ML
AROCLOR 1260	90129R/ AROCLOR 1260	181384	5	1	ML
AROCLOR 1260 IN OIL	AROCLOR 1260 IN OIL P/N'S 32087, 32087-5XX, 32187	181549	1	5	ML
AROCLOR 1260 MIX	AROCLOR 1260 MIX PART NUMBERS 32012,32012-5XX & 32112	181554	1	5	ML
AROCLOR 1260 SOLUTION	PP-361/AROCLOR 1260 SOLUTION	181379	1	2	GM
AROMATIC AMINE CATALYST	CATALYST 11	180376	1	4	OZF
ARSENAL HERBICIDE	ARSENAL HERBICIDE	178853	1	2.5	GL
ASAHIKLIN 225	1663 AEROSOL	181331	43	18	OZF
ASCORBIC ACID	ASCORBIC ACID	147854	10	100	GM
ASPHALT CUTBACK ADHESIVE	ASPHALT CUTBACK ADHESIVE-232	14643	3	1	GL
AVIEX FUEL CONDITIONER ANTI GEL	405005,405028,405032,405055	181511	3	55	GL
AXAREL 6100	AXAREL 6100	14719	1	55	GL
AXAREL(TM) 38	AXAREL(TM) 38	15038	1	1	GL
B-I-N PRIMER SEALER	0900, 0901, 0904, 0908, 0910, 0911, 0914	180621	1	13	OZF
B-I-N PRIMER SEALER	NZO901	179582	2	1	GL
B26 V3 PROMAR VARNISH SANDING SEALER	B26 V3 PROMAR VARNISH SANDING SEALER	14582	1	0.25	GL
B26 V3 PROMAR VARNISH SANDING SEALER	B26 V3 PROMAR VARNISH SANDING SEALER	14582	2	1	GL
B33 W 200, W201, W202, W203	ALKYD FLAT, S-G & EG-SHEL FINISHES-PROMAR 200 EG-SHEL	148290	2	1	GL
B34W402 MIDTONE BASE	ALKYD FLAT, SEMI-GLOSS & EG-SHEL FINISHES	14571	7	1	GL
B42W101 PURE WHITE	B42W101 PURE WHITE	148228	115	1	GL
B49W2 WHITE	B49W2 WHITE	14576	1	1	GL
B50W1 KROMIK WHITE	B50W1 KROMIK WHITE	14612	192	1	GL
B54RZ38 SAFETY RED	B54RZ38 SAFETY RED	14614	2	1	GL
B54W103 DEEPTONE BASE	B54W103 DEEPTONE BASE	179830	1	1	GL
B59 S11	B59 S11	179651	6	1	GL
B60V70 HARDENER	B60V70 HARDENER	14585	4	1	GL
B62W101 PURE WHITE	B62W101 PURE WHITE	14584	4	1	GL
BACTI-GARD	BTG BACTI-GARD	181196	4	5	GL
BARBITURIC ACID	1308-100	180392	1	100	GM
BASE COAT	ISSI FIB BASE COAT FORMULATION 1	180444	2	800	ML
BASE X	PROMAR 400 SEMI-GLOSS	148218	1	1	GL
BASECOAT FOR PRESSURE SENSITIVE PAINT	ISSI FIB7 BASE COAT	181567	5	1	LR
BE SERIES AUTOMOTIVE REINHIBITOR 1	RE4AFTH-1, RE4ATH-55	148512	25	1	GL
BE SERIES AUTOMOTIVE REINHIBITOR 2	STOCK #RE5CFTH-1, RE5CFTH-55	148511	36	1	GL
BEAD SEALER	PRODUCT CODE 16-118, 16-119	147665	3	1	QT
BEARING GREASE	1252K32,34,36 / DOW CORNING(R) 41 EXTREME HIGH TEMP. BEARING	182346	12	5.3	OZN
BELT DRESSING AEROSOL	00607 BELT DRESSING AEROSOL	88264	14	11	OZF
BENSUMEC 4LF PRE-EMERGENT GRASS & WEED HERBICIDE	GORDON'S PROFESSIONAL TURF & ORNAMENTAL PRODUCTS	148394	1	2.5	GL
BIOCIDE	PERMACLEAN PC-56	182101	3	15	GL
BLACK & GRAY HI HEAT SILICONE	97-724	181447	8	1	GL
BLACK NEXTEL URETHANE LACQUER-COMPONENT I	3101-C10	148690	2	1	GL
BLEACH AND REPLENISHER	140 1520 (PART A)	180964	10	10	LB
BLEACH AND REPLENISHER	140 1520 (PART B)	180966	8	1	PT
BLEND-A-COLOR	BLEND-A-COLOR TONER A60B1 BLACK	15290	11	1	QT
BLEND-A-COLOR TONER	A60Y1 YELLOW (INTERIOR ONLY)	15350	7	1	QT
BLEND-A-COLOR TONER	BLEND-A-COLOR A60R1 RED	15354	2	1	QT
BLEND-A-COLOR TONER	BLEND-A-COLOR A60R2 RED OXIDE (MAROON)	15296	2	1	QT
BLEND-A-COLOR TONER	BLEND-A-COLOR A60W1 WHITE	15298	1	1	QT
BLEND-A-COLOR TONER	BLEND-A-COLOR A60Y3 YELLOW OXIDE (DEEP GOLD)	15299	6	1	QT
BLUE BLEND-A-COLOR	BLEND-A-COLOR A60L1	15321	3	1	QT
BLUE LAYOUT FLUID.	603 BLUE LAYOUT FLUID	15310	1	16	OZN
BLUE SHOWER TECH SPRAY	1630-6S/BLUE SHOWER G3	181957	389	16	OZF
BOESHIELD T-9	BOESHIELD T-9	181736	1	1	GL
BOESHIELD T-9	BOESHIELD T-9	181736	4	12	OZF
BOESHIELD T-9	BOESHIELD T-9	181736	4	12	OZN
BOILER WATER TREATMENT	22310/NALCO NEXGEN (OR NALCO NEXGUARD)	181892	1	55	GL
BOILER WATER TREATMENT	22310/NALCO NEXGEN (OR NALCO NEXGUARD)	181892	3	547	LB
BRAKLEEN AEROSOL	PRODUCT: 05089, 5089P, 5089T, 5089TP	179246	30	20	OZF
BRAND FLUID	PF-5060	180653	3	5	GL
BRAND FLUID	PF-5060	180653	1	70	LB
BRAZE CLEANER	POST BRAZE CLEANER	180899	2	5	LB
BRAZING FLUX	STAY SILVER BRAZING FLUX	179076	1	8	OZN

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
BRAZING FLUX	STAY SILVER BRAZING FLUX	180938	6	6.5	OZN
BRAZING FLUX	STAY SILVER WHITE BRAZING FLUX	14767	30	8	OZN
BRAZING FLUXES	STAY SILV WHITE BRAZING FLUX	148741	5	4	OZF
BRIGHT RED	0826	181665	5	16	OZF
BROWN PROCESS COLOR	3M SCOTCHLITE PROCESS COLOR 887I	180537	1	1	QT
BRUSHABLE CONTACT ADHESIVE	3M SCOTCH-GRIP CONTACT ADHESIVE	181700	5	1	QT
BRUSHABLE CONTACT ADHESIVE	FORMICA BRAND 140	148823	1	5	GL
BUFFER PAC	SB105	180052	1	500	ML
BUFFER PAC	SB105	180669	1	1500	ML
BUFFER SOLUTION	1490932 / ACETATE BUFFER SOLUTION, PH4	182146	2	100	ML
BUFFER SOLUTION	BUFFER SOLUTION PH 4.00	180667	1	500	ML
BUFFER SOLUTION	BUFFER SOLUTION PH 4.00 - RED, SB101	147964	4	500	ML
BUFFER SOLUTION	BUFFER SOLUTION PH 7.0 (107-500)	180699	3	500	ML
BUFFER SOLUTION - PH 10	BUFFER - PH C PACK	148736	2	20	LR
BUFFER SOLUTION 3.00	SB97-500	180673	1	500	MG
BUFFER SOLUTION PH 7.0	BUFFER SOLUTION PH 7.0	179332	1	500	ML
BUFFER SOLUTION,STANDARD	SB115-500	180945	1	4	LR
BUFFING COMPOUND	FORMULA FIVE CLEAN 'N GLAZE	181779	1	32	OZF
BUTANE FUEL	MASTER APPLIANCE ULTRATORCH BUTANE FUEL	179777	2	5.5	OZF
BUTANE FUEL	ULTRATANE BUTANE FUEL	182128	2	5	OZF
CAL GAS (.0002-.02% CHLORINE IN NITROGEN)	NON-FLAMMABLE GAS MIXTURE/ .0002-.02% CHLORINE IN NITROGEN	181992	2	2	CF
CAL-TINT II	CAL-TINT II 830-5515 THALO GREEN, 1125822	27332	2	16	OZF
CAL-TINT II BURNT UMBER	830-1313	179472	13	0.5	PT
CALABRATION GAS (NO2 AND/OR O2 IN N2)	NON-FLAMMABLE CALIBRATION GAS MIXTURE	181899	16	58	LR
CALBRATION MIX	48257	179882	1	2000	ML
CALIBRATION GAS	FLAMMABLE GAS MIXTURE	182308	8	200	ML
CALIBRATION GAS	NON FLAMMABLE GAS MIXTURE-CALIBRATION GAS	181911	6	14.1	CF
CALIBRATION GAS	NON-FLAMMABLE CALIBRATION GAS MIXTURE	181919	6	2	CF
CALIBRATION GAS	NON-FLAMMABLE GAS MIXTURE	182307	4	200	ML
CALIBRATION GAS	OXYGEN 0-23.5%; METHANE, 0-2.5%; HYDROGEN SULFIDE, 0.114-0.0	181878	3	25	GM
CALIBRATION GAS	OXYGEN, PROPANE, N-PENTANE, HEXANE, CARBON MONOXIDE	181135	17	552	LR
CALIBRATION GAS	PENTANE 552	181495	2	552	LR
CALIBRATION MIX	48256	179881	1	2000	ML
CALIBRATION STANDARD	47364	179877	1	2000	ML
CALIBRATION STANDARD	47365	179878	1	2000	ML
CALIBRATION STANDARD	47366	179879	1	2000	ML
CALIBRATION STANDARD MIX	47363	179876	1	2000	ML
CARB N CHOKE CLEANER	1924	147868	1	18.75	OZF
CARB-MEDIC CARBURATOR, CHOKE & VALVE CLEANER (AEROSOL)	CARB-MEDIC CARBURATOR, CHOKE & VALVE CLEANER(AEROSOL) M48-24	15048	8	19	OZF
CARBO PAINT	SPI #5006-AB	181867	8	21	ML
CARBO WELD 11 BASE	CARBO WELD 11 BASE	178779	1	0.25	GL
CARBON DIOXIDE	CARBON DIOXIDE	180330	1	50	LB
CARBON DIOXIDE -GAS	CARBON DIOXIDE-CO2 GASEOUS	182029	1	200	CF
CARBON DIOXIDE CYLINDER	CARBON DIOXIDE	182316	1	250	CF
CARBON DIOXIDE, CARBON MONOXIDE, AND OXYGEN IN NITROGEN	CARBON DIOXIDE, CARBON MONOXIDE, ANS OXYGEN IN NITROGEN	181368	1	125	CF
CARBON DIOXIDE, CARBON MONOXIDE, AND OXYGEN IN NITROGEN	CARBON DIOXIDE, CARBON MONOXIDE, ANS OXYGEN IN NITROGEN	181368	1	142	CF
CARBON DIOXIDE, REFRIGERATED LIQUID	CARBON DIOXIDE, REFRIGERATED LIQUID	15172	15	50	CF
CARBON DIOXIDE, REFRIGERATED LIQUID	CARBON DIOXIDE, REFRIGERATED LIQUID	15172	12	50	LB
CARBON DISULFIDE, 99.9%, LOW BENZENE CONTENT	CATALOG # 34227-0 CARBON DISULFIDE	179297	4	1	LR
CARBON DISULFIDE, 99.9%, LOW BENZENE CONTENT	CATALOG # 34227-0 CARBON DISULFIDE	180932	10	1	LR
CARBON MONOXIDE	CARBON MONOXIDE	182062	1	26	CF
CARBON MONOXIDE AND METHANE IN AIR	CARBON MONOXIDE AND METHANE IN AIR	182033	1	35	LR
CARBON MONOXIDE CYLINDER	CARBON MONOXIDE	182317	1	250	CF
CARBON MONOXIDE CYLINDER	CARBON MONOXIDE	182322	1	250	CF
CARBON MONOXIDE CYLINDER	CARBON MONOXIDE	182345	1	200	CF
CARBON PAINT THINNER	SPI #5007	181868	2	60	ML
CARBON STEEL COVERED ARC WELDING ELECTRODE	E 6012	15153	1	1	GL
CARBON TETRACHLORIDE HPLC GRADE	270652	181750	1	100	ML
CARBURETOR CHOKE CLEANER	B-12 CHEMTOOL CARBURETOR CHOKE CLEANER	181497	116	19	OZF
CARBURETOR, CHOKE & VALVE CLEANER	CARB-MEDIC CARBURETOR, CHOKE & VALVE CLEANER	180291	2	12.5	OZF

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
CARBURETOR, CHOKE & VALVE CLEANER	CARB-MEDIC CARBURETOR, CHOKE & VALVE CLEANER	180291	2	19	OZF
CAREFREE FLOOR CARE	CAREFREE	148628	146	5	GL
CARQUEST DIESEL FUEL CONDITIONER W/ANTI-GEL	CARQUEST DIESEL FUEL CONDITIONER W/ANTI-GEL	181770	1	30	ML
CARTRIDGE, ENGINE STARTER	ZERO STARTING FLUID - CYLINDER	179064	2	18	OZF
CAT, 250 G/L WASH PRIMER, H20	CAT, 250 G/L WASH PRIMER, H2O	178977	1	16	OZF
CATALYST	DOW CORNING F CATALYST	180319	28	0.1	LB
CATALYST FOR DP PRIMERS	DP402 (0419951)	178969	9	1	GL
CATALYST FOR EPOXY RESIN	CATALYST 17M-1	182291	2	1	QT
CATALYST FOR EPOXY RESIN	CATALYST 9	182374	2	1	LB
CATAPULT GREASE	BEL-RAY 65147	14715	12	11	OZN
CAULK	ACRYLIC LATEX CAULK	148469	4	10.3	OZF
CAULK	KITCHEN AND BATH SILICONIZED ACRYLIC CAULK	182129	17	10	OZN
CAULK	NP 1	182136	11	12	OZN
CAULKING OR GLAZIER'S COMPOUND	PSI-801/SILITHANE	182332	6	12	OZN
CAUSTIC SODA	SODIUM HYDROXIDE, ANHYDROUS	180801	13	100	LB
CAUSTIC SODA	SODIUM HYDROXIDE, ANHYDROUS	180801	3	500	LB
CAUSTIC SODA ANHYDROUS (ALL GRADES)	M32413	181191	2	100	LB
CAUSTIC SODA-DIAPHRAGM NO.2	M32415 CAUSTIC SODA-DIAPHRAGM NO.2 FLAKE	14987	35	100	LB
CC HIGH TEMPERATURE CEMENT LIQUID BINDER	MSDS-0103 PART B - FOR COMPLETE MSDS CALL 4788 OR 7380.	179688	1	8	OZF
CC HIGH TEMPERATURE CEMENT, POWDER FILL	MSDS-0103 - FOR COMPLETE MSDS CALL 4788/7380	179687	1	8	OZF
CCA-20 COIL CLEANER AEROSOL	CCA-20 COIL CLEANER AEROSOL	181764	20	18	OZF
CEMENT	CPVC-CEMENT	181686	1	16	OZF
CEMENT	WELD-ON 16 FOR ACRYLIC	182243	5	2	OZN
CEMENT	WELD-ON 3 FOR ACRYLIC	182242	2	1	PT
CEMENT	WELD-ON 4 FOR ACRYLIC	182245	2	1	PT
CEMENT (POWDER)	31P ACIDPROOF CEMENT POWDER	181194	2	1	GL
CEMENT 002 CARLON MEDIUM GRAY PVC SOLVENT CEMENT	VC9924 1/2PT., VC9923 PT., VC9922 QT., VC0041P GALLON.	179463	2	1	PT
CEMENT 002 CARLON MEDIUM GRAY PVC SOLVENT CEMENT	VC9924 1/2PT., VC9923 PT., VC9922 QT., VC0041P GALLON.	179463	5	16	OZF
CEMENT LIQUID	31L	181193	3	1	GL
CERAMA-BOND 552	CERAMA-BOND 552	148822	1	1	QT
CERAMA-BOND 552 ADHESIVE	CERAMA-BOND 552 ADHESIVE	178922	1	1	QT
CERAMIC ADHESIVE	940/COTRONICS	181942	1	1	PT
CERAMIC BINDER	791, 792, 793, 794, 795, AND 797/RESBOND CERAMIC BINDERS	181930	1	1	PT
CERAMIC FIBER PRODUCT	FIBERFRAX CERAMIC FIBERS, 7000 SERIES	182274	1	40	LB
CHATEAU GRAY	SPRED FLOOR POLYURETHANE ENAMEL	14651	20	1	GL
CHLORAL HYDRATE	47335-U	179884	1	1000	ML
CHLORINE	CHLORINE	148048	24	150	LB
CHLORINE	CHLORINE	180783	31	150	LB
CHLORINE	CHLORINE	181655	48	150	LB
CHLORINE	CODE: CPE142945 (CHECKED REVISION 5/15/98)	147849	41	150	LB
CHLOROPRENE RUBBER & SYNETHETIC RESIN SOLUTION	CON-BOND 77-0189	148027	1	1	QT
CHLOROTRIFLUOROMETHANE/TRIFLUOROMETHANE	GENETRON 503 AZEOTROPE	15102	10	9	LB
CHROMASOLV PLUS, CHEMICAL	270458/1-METHYL-2-PYRROLIDINONE, CHROMASOLV PLUS	182249	1	100	ML
CHROME ALUMINUM	0530 CONTROLS RUST SPRAY EMAMEL	14884	19	12	OZF
CHROME ALUMINUM	0530 CONTROLS RUST SPRAY EMAMEL	14884	1	16	OZF
CIRCUIT COOLER	FREEZE MIST	15359	5	12	OZF
CIRCUIT SOLVE (AEROSOL)	TM4171	181634	10	12	OZF
CIRCUITWORKS OVERCOAT PEN	CW3300C, CW3300G, CW3300BLKC, CW3300BLKG/OVERCOAT PEN	182340	2	2	OZN
CLASSIC 99 INTERIOR FLAT LATEX WALL PAINT, PURE WHITE	A27W10	15193	110	1	GL
CLEAN N' SAFE RED	CLEAN N' SAFE 00903 RED	15345	2	12	OZF
CLEAN-N-DRI	CLEAN-N-DRI	178636	1	1	GL
CLEANER	02190 / PF PRECISION CLEANER	182145	11	14	OZN
CLEANER	1508/ZEP LUBEZE SUMP CLEANER-NEW	182114	1	1	GL
CLEANER	KABOON SHOWER TUB AND TILE CLEANER	181908	57	36	OZF
CLEANER	M95	181048	283	1	QT
CLEANER	M95	181048	22	12	QT
CLEANER CONCENTRATE	3M BRAND HEAVY DUTY MULTI-SURFACE CLEANER CONCENTRATE	181682	12	2	LR
CLEANER FOR BATTERY TERMINALS	KRYLON 1336 BATTERY CLEANER	15376	16	15	OZF

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
CLEANER-DISINFECTANT-DEODORANT	0679/SPIRIT II	181894	6	2.5	GL
CLEANER-DISINFECTANT-DEODORANT	0679/SPIRIT II	181894	12	32	OZF
CLEANER/DEGREASER	CRYSTAL SIMPLE GREEN	181595	5	1	GL
CLEANER/DEGREASER	CRYSTAL SIMPLE GREEN	181595	8	24	OZF
CLEANER/DEGREASER	CRYSTAL SIMPLE GREEN	181797	5	5	GL
CLEANER/DEGREASER	SUPER 140F CLEANER/DEGREASER	180486	1	55	GL
CLEANER/DISINFECTANT	7520/DZ-7 NEUTRAL CLEANER DISINFECTANT	181990	12	2.5	GL
CLEANING AND ETCHING SOLUTION	0108 402	181051	9	1	GL
CLEANING COMPOUND,SOLVENT SOLUTION	MS-230 CONTACT RE-NU	107836	1	16	OZF
CLEANING DETERGENT	SP CONCENTRATE	148153	6	55	GL
CLEANING LIQUID COMPOUND	BB-1818	178551	6	55	GL
CLEANING SOLVENT	AXAREL 6100	181181	1	55	GL
CLEANING SOLVENT 755 (AEROSOL)	75559	181732	1	112	OZF
CLEAR ACRYLICS	1302 ACRYLIC CRYSTAL	14803	12	16	OZF
CLEAR THINNER	F041-004	181833	1	1	GL
CLP SEMIVOLATILE CALIBRATION MIX	506508	180585	1	3	ML
CO2 LIQUIFIED	CARBON DIOXIDE	180459	1	8000	LB
COAL TAR PITCH	COAL TAR ROOFING PITCH	180269	4	5	GL
COATING MATERIAL	PLISTIX 900F	181862	2	50	LB
COBALT (II) NITRATE HEXAHYDRATE, 98+,A.C.S. REAGENT	PRODUCT # 23926-7	148052	2	5	GM
CODE: C-135	SPECIAL STRIPPER	14724	9	5	GL
COIL CLEANER	CCL-COIL CLEANER	181626	24	1	GL
COIL CLEANER	COIL RENEW 933	179981	2	1	GL
COIL CLEANER	CSF-ACID-BASED FOAM COIL CLEANER	181628	17	1	GL
COIL CLEANER	RT300G	181253	5	1	GL
COIL CLEANER AEROSOL	CCA-20	178877	12	18	OZF
COLD GALVANIZING COMPOUND	0003897	181869	12	20	OZN
COLORPLACE SPRAY ENAMEL	20005 (RED)	181061	5	16	OZF
COLORPLACE SPRAY ENAMEL	20005 (WHITE)	181062	10	16	OZF
COMMUNICATIONS ORANGE MARKING PAINT	PRODUCT NUMBER 4629 PAINT	179404	12	13	OZF
COMPOUND	INTERNATIONAL COMPOUND 2497-D	180484	3	55	GL
COMPOUND	INTERNATIONAL COMPOUND 2497-D	181284	12	55	GL
COMPOUND	NICROBRAZ GREEN STOP-OFF TYPE I	182150	1	1	LR
COMPRESSED GAS	CALIBRATION GAS (MIXTURE)	182226	1	2	LR
COMPRESSED GAS	CALIBRATION GAS (NITROGEN)	182228	3	2	LR
CONCENTRATED AQUEOUS CLEANER	HARVEY'S POWER GREASE AND TAR CUTTER	178748	1	1	QT
CONCEPT 2020 CC	DCU2020, DCC35538 (062195D)	178971	1	1	GL
CONDITIONING REAGENT	ASTM D516-90 CONDITIONING REAGENT	182250	1	100	ML
CONDUCTIVE COATING (COPPER)	DIP IT CONDUCTIVE COATING	182130	1	12	OZF
CONDUCTIVE PEN	CW2200MTP, CW2200STP, CW2200BLK/CIRCUITWORKS CONDUCTIVE PEN	182339	2	2	OZN
CONDUCTIVITY STANDARD	LC18780	180944	1	1	LR
CONSTRUCTION ADHESIVE	CA 3200 GENERAL PURPOSE CONSTRUCTION ADHESIVE	148755	35	29	OZF
CONTACT CEMENT-NOMACO P/N 1A-2E	FOSTER 82-31 (NOMALOCK-LEAKTITE)	181294	2	8	OZN
CONTACT CLEANER	04016/NO FLASH ELECTRO CONTACT CLEANER	181889	3	15	OZN
CONTACT CLEANERS	KONTACT RESTORER	15252	2	6	OZF
CONTACT INSECTICIDE FORMULA 1	PRESCRIPTION TREATMENT BRAND P.I.	181751	12	18	OZF
COROTHANE - ALIPHATIC FINISH COAT, WHITE	B66WQ15	148518	17	1	GL
COROTHANE* I - THINNER - REDUCER	R7KQ10	148516	17	1	GL
CORROSION PREVENTIVE COMPOUND	WD-40 BULK LIQUID	14996	2	5	GL
CORROSION PREVENTIVE COMPOUND	WD-40 BULK LIQUID	147835	16	0.06	GL
CORROSION PREVENTIVE COMPOUND	WD-40 BULK LIQUID	147835	11	0.13	GL
CORROSION PREVENTIVE COMPOUND	WD-40 BULK LIQUID	147835	6	1	GL
CORROSION PREVENTIVE COMPOUND	WD-40 BULK LIQUID	147835	45	1	PT
CORROSION PREVENTIVE COMPOUND	WD-40 BULK LIQUID	147835	8	1	QT
CORROSION PREVENTIVE COMPOUND	WD-40 BULK LIQUID	147835	24	6	OZF
CORROSION PREVENTIVE COMPOUND	WD-40 BULK LIQUID	147835	8	12	OZF
CORROSION PREVENTIVE COMPOUND	WD-40 BULK LIQUID	147835	12	16	OZF
CORROSION PREVENTIVE COMPOUND	WD-40 BULK LIQUID	147835	7	32	OZF
CORROSION PREVENTIVE COMPOUND	WD-40 BULK LIQUID	147835	1	55	GL
CORROSION/SCALE INHIBITOR	2833/NALCO CORROSION/SCALE INHIBITOR	181928	2	15	GL
COTRONICS DURAPOT (PART B)	800 SERIES/COTRONICS DURAPOT (PART B)	181931	1	1	QT
COTRONICS MOLD RELEASE	REPLICAST 101 MR	181713	1	18	OZF
COUMARIN	450	148303	1	6	GM
COVER CLEAR	1250	178984	1	1	GL
CRUSHED GLASS	6ZC15/GLASS BLAST MEDIA	182147	2	5	GL

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
CRYSTAL CLEAR KRYLON	1303	180370	3	11	OZF
CSF ACID BASED FOAM COIL CLEANER	CSF - ACID BASED FOAM COIL CLEANER	181762	51	1	GL
CUPRIC SULFATE	EM-CX2185-1	181304	1	500	MG
CURING AGENT	0305 FLEXANE 94 LIQUID CURING AGENT	182139	7	10	LB
CURING AGENT	AB9277000 / EA 9394 PART B	182275	3	6	OZN
CURING AGENT	M-BOND CURING AGENT 600/610 (PART B)	180684	1	8	OZF
CUSTOM ANION STANDARD	AS-BR9-2Y OR AS-BR9-2X	180778	1	1000	ML
CUSTOM ANION STANDARD	AS-CL9-2Y, AS-CL9-2X, AS-CL9-1X, AS-CL9-1Y	180457	1	100	ML
CUSTOM ANION STANDARD	AS-F9-2Y OR AS-F9 2X	180779	1	1000	ML
CUSTOM ANION STANDARD	AS-P049-2Y	180947	1	100	ML
CUSTOM ANION STANDARD	AS-PO49-2Y OR AS-PO49-2X	180456	2	100	ML
CUSTOM MULTIELEMENT SOLUTION STANDARD	CUSTOM MULTIELEMENT SOLUTION STANDARD	178830	1	500	ML
CUSTOM PLASMA STANDARD	PLCR9-2X	179766	1	500	ML
CUSTOM PLASMA STANDARD	RSCN9-2X, RSCN9-2Y	181164	1	500	ML
CUTTER INSECT REPELLENT SPRAY	CUTTER INSECT REPELLENT SPRAY	178881	52	6	OZF
CUTTING OIL	1377 / LUBEZE 14	182244	1	55	GL
CYANIDE	502 CYANIDE	181146	2	2	MG
CYANIDE	502 CYANIDE	181295	1	2	MG
CYANIDE	502 CYANIDE	181295	3	125	ML
CYLINDER, NITROGEN	NITROGEN	15004	1	230	LB
CYNOFF WP INSECTICIDE	1070	181264	6	1	LB
D&M DARK GREEN SG POLY	UG-06961B	179435	1	5	GL
D-19 DEVELOPER	146 4593	180799	1	20	LB
DARACLEAN 282GF	DARACLEAN 282GF	179263	2	55	GL
DARACLEAN 282GF	DARACLEAN 282GF	179353	5	55	GL
DARACOAT 615	DARACOAT 615	179264	1	5	GL
DE-ICER	PYROIL WINDSHIELD DE-ICER 1030	14962	56	11.5	OZF
DE-ICER	WARREN DE-ICER	182084	3	11.5	OZF
DEBONDER	57004921/DEBONDER	182094	1	1	OZF
DEEP WOODS OFF	DEEP WOODS OFF	179902	61	6	OZF
DEEP WOODS OFF	DEEP WOODS OFF	181738	273	6	OZF
DEGREASER	0570 / I.D. RED (LIQUID)	182305	2	5	GL
DEGREASER	SF-1 SOLVENT FREE DEGREASER CONCENTRATE	182148	4	1	GL
DEMON EC	DEMON EC	180050	2	3	PT
DENATURED ETHANOL MIXTURE.	SYNASOL SOLVENT, PM-3224, 190 PROOF	147867	1	0.88	GL
DENATURED ETHANOL MIXTURE.	SYNASOL SOLVENT, PM-3224, 190 PROOF	147867	1	1	GL
DETERGENT	OSMO AK-110	181227	12	45	LB
DEVELOPE,PHOTOGRAPHIC	188 8742,VNF1/RVNP COLOR DEVELOPER, PART A	181587	2	2	CC
DEVELOPE,PHOTOGRAPHIC	188 8742,VNF1/RVNP COLOR DEVELOPER, PART A	181587	5	2	LR
DEVELOPER	1503/AUTEX RP DEVELOPER REPLENISHER, CONCENTRATE	182370	6	19	LR
DEVELOPER	RA 66 DEVELOPER	180403	2	2.5	GL
DEVELOPER	RA 77 DEVELOPER	179279	1	2.5	GL
DEVELOPER	ZYGLO DEVELOPER ZP-9F	181065	48	12	OZF
DEVELOPER/REPLINISHER PARTS A,B & C	KODAK 139-7215	181788	3	75	LR
DIBASIC SODIUM PHOSPHATE	DISODIUM PHOSPHATE ANHYDROUS POWDER	181978	2	50	LB
DICHLORODIFLUOROMETHANE	GENETRON 12	14693	19	145	LB
DICHLORODIFLUOROMETHANE SOLUTION	HC-140	180893	1	4	ML
DICHLOROMETHANE	D151-4	180717	5	1	GL
DICHLOROMETHANE	DX0837	180018	4	4	LR
DICHLOROMETHANE	DX0837	181074	14	4	LR
DICHLOROMETHANE (METHYLENE CHLORIDE) CAS#75-09-2	DATAKOAT SPRAY #04177, #04178	147743	3	16	OZF
DICHLOROTRIFLUOROETHANE, TECHNICAL	SUVA 123	179970	7	100	LB
DIESEL FUEL 2 COMPOSITE	32093-520	180726	1	5	ML
DIESEL FUEL COMPOSITE LAB STANDARD	XHC DIESEL FUEL #2 COMPOSITE STANDARD	181918	3	5	ML
DIESEL FUEL CONDITIONER W/ANTI-GEL	8A, 8B, 8C, 8D, 8A-7	179258	1	1	QT
DIESEL FUEL CONDITIONER W/ANTI-GEL	8A, 8B, 8C, 8D, 8A-7	179258	46	14	OZF
DIF GEL 02431, 02432	DIF GEL 02431, 02432	181927	2	1	GL
DIPHENYLCARBAZONE-BROMOPHENOL BLUE	LC13680	180464	1	125	ML
DODECANE	DODECANE	181131	1	400	ML
DOT 5 SILICONE BRAKE FLUID	DOT 5 SILICONE BRAKE FLUID	181772	3	11	OZF
DOVE GRAY	1605 DOVE GRAY	178874	1	12	OZF
DOVE GRAY	1605 DOVE GRAY	178874	1	12	OZN
DOW CORNING 832 MULTI SURFACE SEALANT	DOW CORNING (R) 832 MULTI-SURFACE ADHESIVE SEALANT	181761	84	10.1	OZF
DPD FREE CHLORINE REAGENT	DPD FREE CHLORINE REAGENT	179474	8	10	ML

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
DPD REAGENT #1	R-0001	179512	5	22	ML
DPD REAGET #2	R-0002	179511	5	22	ML
DRIER	JD-40 GILLESPIE JAPAN DRIER	38914	1	1	QT
DTM BONDING PRIMER	B66A50	148289	51	1	GL
DURA FLEX W/B CONC SEALER	PO-2644	181258	6	55	GL
DURALCO 4420 - DURALCO 455	DURALCO 4420 - DURALCO 455	182067	6	12	OZN
DURAPOT 800 SERIES REFRACTORY CERAMIC (PART A)	80O SERIES DURAPOT REFRACTORY (PART A)	181932	1	1	QT
DURSBAN PRO INSECTIDE	PRODUCT CODE: 46482	180085	8	1	PT
DUSTER	PART #1671 AEROSOL	148196	12	8	OZN
DUSTER	PART #1671 AEROSOL	148200	124	10	OZN
DUSTER	PART #1671 AEROSOL	148200	125	12	OZN
DUSTER	TECHNI-TOOL DUSTER	181028	36	10	OZF
DYCLEAN	DYCLEAN	178694	3	1	GL
DYE	04500 / COUMARIN 450	182295	1	40	GM
DYE	LESCO TRACKER	182333	2	2.5	GL
DYKEM HI-SPOT BLUE NO.107	DYKEM HI-SPOT BLUE NO.107	14595	2	3	OZF
E-SERIES ULTRAJET	ES670, ES1020, ES1270-6, ES1570	147853	1	8	OZN
E-SERIES ULTRAJET	ES670, ES1020, ES1270-6, ES1570	147853	14	10	OZN
E-SERIES ULTRAJET ES1020	ES670, ES1020, ES1270-6, ES1570	180323	209	10	OZN
E-Z CUT AEROSOL	E-Z CUT AEROSOL	182096	12	13	OZF
EASY TOUCH ACOUSTIC	4080 EASY TOUCH ACOUSTIC (MEDIUM)	181717	3	16	OZN
ELASTOMER QD CONDITIONER	1200/1300 BELZONA (PART A)	181328	1	165	GM
ELECTRO-WASH PX	ES1210, ES810B, ES1210C, ES810BC	181609	23	12	OZF
ELECTROLYTE (SULFURIC ACID SOLUTION)	ELECTROLYTE (SULFURIC ACID SOLUTION)	149133	1	8	OZF
ENAMEL	156L 1 SHOT (R) LETTERING ENAMEL	130232	6	1	PT
ENAMEL (INCLUDES SAND)	4110-57068 GLYPTEX URETHANE ENAMEL	181282	10	1	GL
ENAMEL (INCLUDES SAND)	4110-57068 GLYPTEX URETHANE ENAMEL	181283	1	20	OZF
ENAMEL PLUS GLOSS SCREEN INK	59112 WHITE	178689	4	0.1	QT
ENAMEL PLUS GLOSS SCREEN INK	59112 WHITE	178689	1	1	QT
ENAMEL,YELLOW,13538,AEROSOL	SO SURE YELLOW 13538 44-130	122106	2	10.5	OZF
ENGINE CLEANER	B&B 3100	180636	2	5	GL
ENGINE STOR	06068	181658	6	13	OZF
ENVI-RO-TECH 1676 DEFLUXER AEROSOL	ENVI-RO-TECH 1676 DEFLUXER	14653	192	22	OZF
ENVI-RO-TECH 1677 UNIVERSAL CLEANER	ENVI-RO-TECH 1677 UNIVERSAL CLEANER/DEGREAS	84441	1	22	OZF
ENVI-RO-TECH 1678 CLEANER/DEGREASER	ENVI-RO-TECH 1678 CLEANER/DEGREASER	14652	12	22	OZF
ENVI-RO-TECH FREEZER	1672 AEROSOL	178816	3	10	OZF
ENVI-RO-TECH FREEZER	1672 AEROSOL	178816	113	12	OZF
EP 921	EP 921	148047	1	1	GL
EP 921	EP 921	148047	2	5	GL
EP 921	EP 921	148047	1	53	GL
EPA 552 HALOGENATED ACETIC ACIDS MIX	48047	181033	7	4	MG
EPCON GRANITE V RESIN	1740R (PART A)	180999	19	18	OZF
EPOXY	95-249 / EPOXY MASTIC CATALYST	182360	2	1	GL
EPOXY	95-249 / EPOXY MASTIC CATALYST COMP B	182304	4	1	GL
EPOXY	ADHESIVE-SCOTCH-WELD 2216 (PART B)	179917	1	0.75	QT
EPOXY	CAT, RED CRO4 FREE PRIMER	178981	1	32	OZF
EPOXY	DURALCO 134/COTRONICS EPOXY	181945	1	8	OZF
EPOXY	DURALCO 4540/EPOXY ADHESIVEE	182072	1	1	PT
EPOXY	DURALCO 4700/EPOXY ADHESIVE	182071	1	1	PT
EPOXY	EP46HT-IND-2 PART A	182056	1	1	QT
EPOXY	EP46HT-IND-2 PART B	182057	1	1	PT
EPOXY	FC20 CONVERTOR	181832	1	1	GL
EPOXY	IEC-OPB-0000 / INDUSTRIAL EPOXY COATING	182215	1	1	GL
EPOXY	OM125-PART A/EPO-TEK	182118	12	4	GM
EPOXY	PC4444A (PORTERGLAZE 4400 NEUTRAL BASE)	181273	1	1	GL
EPOXY	PRODUCT CODE:44W007CAT	178986	1	8	OZF
EPOXY	TRA-BOND 2151 HARDENER	182013	2	2	OZN
EPOXY ADHESIVE	28654/ADHESIVE	181882	22	2.5	GM
EPOXY ADHESIVE	HYSOL EA 9330 (PART A)	180943	2	1	QT
EPOXY ADHESIVE	STYCAST 2850FT BLACK	180368	1	1	QT
EPOXY ADHESIVE COREACTANT	TRA-BOND F113SC HARDENER	178943	1	3.5	GM
EPOXY ADHESIVE CORECTANT	TRA-BOND 2151 HARDENER	179626	1	1.5	OZF
EPOXY ADHESIVE RESIN	TRA-BOND 2151 RESIN	179627	1	0.5	OZF
EPOXY ADHESIVE, PART A	EPO TEK 353 ND, PART A, ADHESIVE	181391	10	2	GM
EPOXY ADHESIVE, PART B	EPO TEK 353 ND, PART B, ADHESIVE	181392	10	2	GM
EPOXY COATING	SHELCOAT II EPOXY, WHITE 920-W-355	178541	1	4	GL
EPOXY COATINGS	B58V1 PART X HARDENER	178997	8	1	GL
EPOXY COATINGS	B58W101 PART W PURE WHITE	179259	5	1	GL
EPOXY COATINGS	B67H5 PART G TAN	147884	38	1	GL

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
EPOXY COATINGS	B67V5 PART H/HARDENER	147891	12	1	GL
EPOXY COATINGS	KEM CATI-COAT B42WA8 (PART A)	178554	1	5	GL
EPOXY COATINGS; HARDENER	EPOXY COATINGS HARDENER B58V1	148702	2	1	GL
EPOXY HARDENER	48105(48008)/JB WELD EPOXY STEEL HARDENER	182039	1	3	OZN
EPOXY HARDENER	760 & 733 TOUGH AS TILE-WHITE (PART A)	179957	1	8	OZF
EPOXY HARDENER PART B (9309NA)	AA9234000 / EA 9309NA PART B	182015	4	1	OZN
EPOXY KIT	EPK 1C HARDENER	148618	21	1.2	OZN
EPOXY KIT	EPK 1C RESIN	148617	20	2.8	OZN
EPOXY KIT	EPK 1C RESIN	148617	1	8	OZN
EPOXY KIT	M-BOND CURING AGENT-TYPE 10	181142	1	1	ML
EPOXY PAINT	B62WZ113/TILE CLAD HIGH SOLIDS EPOXY	181954	20	1	GL
EPOXY RESIN	4UK12 - ADHESVIE EPOXY	182229	2	6	OZN
EPOXY RESIN	DURAPOT 863 EPOXY RESIN	181947	1	1	PT
EPOXY RESIN	E-20HP	181857	8	1.7	OZN
EPOXY RESIN	PR1935/PLASTIC MATERIAL LIQUID, N.O.I.	182003	1	1	GL
EPOXY RESIN	PR2848/PLASTIC MATERIAL LIQUID, N.O.I.	182002	1	1	GL
EPOXY RESIN	SPEED STICK, EPOXY PATCHING PUTTY, STEEL REINFORCED	182347	9	4	OZN
EPOXY RESIN	STYCAST 1090 SI RED	178742	1	1	QT
EPOXY RESIN	STYCAST 2651MM BLACK	182373	2	12	LB
EPOXY RESIN	STYCAST 2762FT BLACK	179956	1	3	LB
EPOXY RESIN	STYCAST 2762FT BLACK	180563	1	1	QT
EPOXY RESIN	STYCAST 2762FT BLACK	182290	2	3	LB
EPOXY RESIN BLEND PART A & B	OSMOWELD MPF	181709	40	1500	ML
EPOXY RESIN PART A (9309NA)	AA9234000 / EA 9309NA PART A	182014	4	1	OZN
EPOXY RESIN, DILUENT, PIGMENT, & FILLER MIXTURE	CEILCOTE 663 CEILGARD, PART A	178724	1	6.75	LB
EPOXY RESIN/AMINE HARDENER-BASED PUTTY	8785-10 (THIS COVERS A&B)	179994	1	1	LB
EPOXY RESINS	EPOXY RESINS	182131	1	2	OZN
EPOXY SOLUTION	#737 TOUGH AS TILE-CLEAR (PART B)	179958	1	8	OZF
ESCORT HERBICIDE	DU001203	180091	1	8	OZF
ETHCING FILLER	ETCH-LOC /562	148245	2	1	GL
ETHER	EX0182	180027	1	4	LR
ETHYL ALCOHOL	ETHYL ALCOHOL	14628	1	0.03	GL
ETHYL ALCOHOL	ETHYL ALCOHOL	14628	12	1	GL
ETHYL ALCOHOL	ETHYL ALCOHOL, 200 PROOF	180311	52	1	GL
ETHYL ALCOHOL	ETHYL ALCOHOL, 200 PROOF	180311	8	1	QT
ETHYL ALCOHOL	ETHYL ALCOHOL, 200 PROOF	180311	4	32	OZF
ETHYL ALCOHOL, DENATURED	ETHYL ALCOHOL, DENATURED	14587	1	1	GL
ETHYL ALCOHOL, DENATURED	ETHYL ALCOHOL, DENATURED	14587	2	1	LR
ETHYLENE	ETHYLENE	181022	1	38	LB
ETHYLENE GLYCOL	BULK ANTIFREEZE, PAR ANTIFREEZE	178594	4	55	GL
ETHYLENE GLYCOL	ETHYLENE GLYCOL	148754	141	55	GL
ETHYLENE GLYCOL	ETHYLENE GLYCOL	180262	5	55	GL
ETHYLENE GLYCOL	ETHYLENE GLYCOL (ALL GRADES)	180818	11	55	GL
ETHYLENE GLYCOL	ETHYLENE GLYCOL, IRON & CHLORIDE FREE GRADES	178982	7	5	GL
ETHYLENE GLYCOL	M25052	179776	55	55	GL
ETHYLENE GLYCOL	M25052	179776	1	2000	GL
ETHYLENEDIAMINE ANHYDROUS CHEMICAL	ETHYLENEDIAMINE ANHYDROUS	182151	1	500	ML
ETHYLENEDIAMINE TETRAACETIC ACID, DISODIUM SALT, DIHYDRATE	S311-500	180672	1	500	ML
EXTERIOR ACRYLIC PAINT, WHITE	520/ACRI-SHIELD EXTERIOR ACRYLIC	181902	1	1	QT
EXTINGUISHER,FIRE,DRY CHEMICAL	FORAY DRY CHEMICAL EXTINGUISHING AGENT	148614	3	50	LB
EXTRACTION RINSE	EXTRACTION RINSE	181200	22	1	GL
EXXON SYSTEM CLEANER	7341221-00	181940	1	5	GL
F9991 LIQUID ROOF	F9991	181775	9	5	GL
FAST DRY GLOSS VINYL INK	44-000 SERIES FAST DRY GLOSS VINYL INK	70558	2	1	GL
FAST DRY GLOSS VINYL INK	44-000 SERIES FAST DRY GLOSS VINYL INK	70558	5	1	QT
FAST-DRYING POLYURETHANE CLEAR SEMI-GLOSS	71029	181838	2	1	GL
FBA FOAM BLAST	FBA FOAM BLAST	181763	19	16	OZF
FC PROFESSIONAL INSECT CONTROL ANT KILLER BAIT GEL	ANT KILLER BAIT GEL RESERVOIRS	181753	13	27	GM
FERTILIZER	2013250 / 13-2-13 + MICROS	182196	1	50	LB
FERTILIZER	AMINOSOL 10-4-10	182318	1	2.5	GL
FIBERFRAX LDS MOLDABLE (CALKING GRADE)	MSDS NO 136/M0105	179240	14	11	OZF
FILLER, WOOD, PLASTIC	X-532	15205	2	8	OZN
FINISHING PUTTY	100400/POLYESTER GLAZING PUTTY	182369	12	2.3	LB

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
FIRE ANT BAIT	EXTINGUISH PROFESSIONAL FIRE ANT BAIT	182164	1	25	LB
FIX ALL RED PRIMER	K1319WZ	178712	8	12	OZF
FIXER	RA 78 FIXER	179278	8	1	GL
FIXING BATH,PHOTOGRAPHIC	78-9020-0160-7 FIXER/SEE SUPPL DATA	93129	35	1	QT
FLAKED	BENZOIC ACID, TECHNICAL GRADE	180303	2	100	GM
FLAT WHITE	1502 FLAT WHITE	178875	7	12	OZF
FLEETGUARD DCA-4 LIQUID	FLEETGUARD DCA-4 LIQUID	181769	25	16	OZF
FLEX-SEAL HIGH-GLOSS CLEAR	3201	181247	18	1	GL
FLOOR & TILE ADHESIVE	430 SOUTHLAND FLOORING ADHESIVE	179539	4	1	GL
FLOOR CLEANER	STRIDE FLORAL SUPER CONCENTRATE	181228	17	32	OZF
FLOOR FINISH	DISCHARGE STATIC DISSIPATIVE FLOOR FINISH	181574	6	1	GL
FLOOR STRIPPER	1071 / ZEP STRIP-EASE	182306	3	1	GL
FLOW ADDITIVE	SCOTCHLITE FLOW ADDITIVE 892	180320	1	8	OZF
FLUORANTHENE	CATALOG NO. F01470	148392	1	5	GM
FLUORENE	CATALOG NO. F01500	148391	1	5	GM
FLUORESCENT GLO PAINT	FLUORESCENT GLO PAINT	179371	1	12.5	OZF
FLUORESCENT GLO PAINT	FLUORESCENT GLO PAINT	181712	9	12.5	OZF
FLUORIDE	44442 / APADNS REAGENT FOR FLUIRIDE	182248	10	2	ML
FLUORINE	FLUORINE F2	182044	1	20	CF
FLUORINE CYLINDER	FLUORINE	182319	1	80	CF
FLUORSCENT ORANGE	SO SURE FLUORESCENT ORANGE	180141	1	10	OZF
FLUROESCENT MARKING PAINTS	18207-18210	181434	30	20	OZF
FLUSHING OIL	CATALOG NO. 3000-8, 3000-16,3000-32, 3000-128, 3000-640	179841	6	5	QT
FLUSHING OIL	CATALOG NO. 3000-8, 3000-16,3000-32, 3000-128, 3000-640	179849	1	1	GL
FLUX	ALL-STATE GENERAL PURPOSE AND STAINLESS STEEL SOLDERING FLUX	180350	6	4	OZN
FLUX	HANDY FLUX B-1	180898	4	1	LB
FLUX	M-FLUX AR	181358	2	1	OZF
FOAM COIL CLEANER	FOAM N' CLEAN FNC	181627	44	1	GL
FOAM COIL CLEANER	FOAM N' CLEAN FNC	181860	2	1	GL
FORM-A-GASKET SEALANT, HIGH TEMP. SILICONE	26C	181302	17	10	OZN
FORMULA-8 AQUEOUS PASTE & FILLER OF PTFE	FORMULA-8 (OXYGEN COMPATIBLE)	181877	3	3.5	OZN
FOUNDATION CEMENT COMPOUND	EUCOSEAL FOUNDATION CEMENT COMPOUND	182004	2	50	LB
FREE CHLORINE BUFFER FOR CL-17 ANALYZER	23141-11	180905	11	473	ML
FREE CHLORINE INDICATOR	FREE CHLORINE INDICATOR SOLUTION FOR CL-17	180903	6	473	ML
FREE CHLORINE INDICATOR SOLUTION FOR CL-17 ANALYZER	23140-11	180904	10	473	ML
FREESTYLE (R) CALCIUM HYPOCHLORITE	1154	179027	18	8	LB
FREON 113	FREON 113	180991	8	60	LB
FREON 22	FREON 22	180324	1	1000	LB
FREON 22 WITH DYTEL LEAK DETECTIVE	FREON 22 WITH DYTEL LEAK DETECTIVE	14560	1	125	LB
FREON 500 REFRIGERANT	FREON 500 REFRIGERANT	179379	1	125	LB
FREON 502	FREON 502	12008	3	125	LB
FUEL STABILIZER	1132NEW-STABIL FUEL CONDITIONER, STABILIZER	182203	2	8	OZF
FUNGICIDAL PROTECTIVE COATING	FOSTER 40-20	181661	2	5	GL
FUNGICIDE	PROSTAR 70 WP FUNGICIDE	182192	5	1	LB
FUNGICIDE	QUALI-PRO MEFENOXAM 2 AQ	182301	1	1	GL
FUNGICIDE	QUALI-PRO TM/C WDG	182298	4	5	LB
FUNGICIDE	SYS TEC 1998 FL	182191	1	2.5	GL
FUNGICIDE	VITA-SEA	182297	3	2.5	GL
GALVINIZED REPAIR COMPOUND (LIQUID)	2011-20014/GALVITE	181898	1	1	GL
GAS ANTI-FREEZE	IG-LO GAS ANTI-FREEZE	179006	1	12	OZF
GAS CYLINDER	1810-2187	178715	1	53	LR
GAS CYLINER	ETHANOL IN NITROGEN	182300	1	200	CI
GAS MIX	20% OXYGEN, 80% ARGON	180624	4	225	CF
GAS MIX	ACETYLENE, ETHYLENE, METHANE, PROPANE, PROPYLENE, TOLUENE,	181743	1	150	CF
GAS MIX	BUTANE, ETHANE, HEXANE, METHANE, PENTANE, PROPANE, BALANCE N	181744	1	142	CF
GAS MIX	CARBON MONOXIDE IN AIR	181499	1	220	CF
GAS MIX	FORMALDEHYDE W/BALANCE NITROGEN	181741	1	29.4	LR
GAS MIX	HYDROGEN 35% ARGON 65%	181596	10	200	CF
GAS MIX	NITROGEN DIXOIDE IN AIR	181313	1	83	LB
GAS MIX	NITROGEN/NITRIC OXIDE MIX	181602	1	58	LR
GAS MIX	PROPANE IN AIR	181464	1	150	CF
GAS MIX	PROPANE/AIR	181678	1	90.19	CF
GAS MIX NITRIC OXIDE W/BALANCE NITROGEN	NITRIC OXIDE W/BALANCE NITROGEN	181706	1	144	CF

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
GAS MIXTURE	CALIBRATION GAS MIXTURE	182280	2	103	LR
GAS MIXTURE	GAS MIXTURE/C0,CO2,N2,O2,CH4,H2,HE	182108	1	14	CF
GAS MIXTURE	GAS MIXTURE/C2H2,CO,CO2,C2H6,C2H4,CH4,N2	182105	1	14	CF
GAS MIXTURE	GAS MIXTURE/CO,CO2,CH4,HE	182106	1	14	CF
GAS MIXTURE	GAS MIXTURE/CO,CO2,H2,O2,HE	182107	1	14	CF
GAS MIXTURE	GAS MIXTURE/CO2, CO, CH4, O2, N2	182102	1	14	CF
GAS MIXTURE	GAS MIXTURE/CO2,CO,CH4,O2,N2	182104	1	14	CF
GAS MIXTURE	GAS MIXTURE/H2, N2	182103	1	14	CF
GAS MIXTURE	NON-FLAMMABLE GAS MIXTURE	181452	5	103	LR
GASKET ELIMINATOR	LOCTITE GASKET ELIMINATOR 515	181582	15	50	ML
GASKET FORMING COMPOUND	3D,GASKET FORMING COMPOUND	109826	3	16	OZN
GASOLINE RANGE ORGANICS STANDARD	30065-520	181363	1	2500	ML
GC JIFFY BATH CONTACT CLEANER	19-638, 19-640	181785	8	4	OZN
GE SILICONES	IS808 SILICONE INDUSTRIAL SEALANT	181784	11	10.1	OZN
GE112A SILICONE RUBBER COMPOUND	GE112A SILICONE RUBBER COMPOUND	182122	22	10.1	OZN
GEAR LUBRICANT	MOBILTAC E	14575	56	13	OZF
GEAR OIL	MOBILGEAR 632	15201	1	55	GL
GENTROL IGR CONCENTRATE PESTICIDE	GENTROL IGR CONCENTRATE	181721	12	1	PT
GLASS BEADS	3386K71/GLASS BLAST MEDIA	182158	8	50	LB
GLASS CLEANER	2000 OPTICS CLEANER	148262	1	16	OZF
GLASS CLEANER (AEROSOL)	GC-1	14868	1	19	OZF
GLAZING COMPOUND	DAP 33 GLAZING COMPOUND	14686	1	1	GL
GLID-GUARD ALKYD INDUSTRIAL ENAMEL	4554 GLID-GUARD ALKYD INDUSTRIAL ENEMAL	147883	4	1	GL
GLOSS INK 70-000 SERIES	70-000 SERIES PLASTI-VAC GLOSS INK, 70112	164082	1	1	QT
GLOSS INK 70-000 SERIES 70158	70-000 SERIES PLASTI-VAC GLOSS INK, 70158	164085	1	1	QT
GLOW GREEN TRACER DYE	T-100/OS31 FLUORESCENT TRACER MIXTURE	182257	1	1	PT
GOLDEN OAK	210B MINWAX WOOD FINISH	181219	2	1	QT
GRAY PRIMER	CLEAN 'N SAFE 00900	148771	11	12	OZF
GRAY PRIMER	S60340	179997	35	12	OZF
GRAY PRIMER 980603, V2182	RUST-OLEUM, GRAY PRIMER 5H903, 5H904, 5H906, 5U705	182055	15	15	OZF
GREASE	EXTREME PRESSURE LUBE #3	178815	2	4	OZF
GREEN CONCENTRATE	FLUORESCENT GREEN CONCENTRATE	180836	4	0.75	OZF
GREEN PAINT	018180 / LESCO TOURNAMENT MARKING PAINT-GREEN	182186	6	16	OZF
HALOACETIC ACIDS	PHM-552A	181625	2	4	MG
HAND SANITIZER (1 LITER)	0880/ZEP FOAM SAN	181895	6	1	LR
HAND SANITIZER (550 ML)	0880/ZEP FOAM SAN	181896	6	550	ML
HANDI-FOAM EPANDING ONE-COMPONENT FOAM SEALANT	HANDI-FOAM	181323	59	24	OZF
HANDI-FOAM EXPANDING ONE-COMPONENT FOAM SEALANT	HANDI-FOAM EXPANDING ONE-COMPONENT FOAM SEALANT	181767	21	20	OZF
HARD HAT SPRAY PAINT	2264 FLUORESCENT RED SPRAY PAINT	180933	2	12	OZF
HARD HAT SPRAY PAINT	2264 FLUORESCENT RED SPRAY PAINT	180933	1	17	OZF
HARDENER	ARALDITE 2011/B	179543	17	100	ML
HARDENER	ARMOR SEAL 5020,PART #B60 VQ5020,PART B	178537	1	5	OZF
HARDENER	ARMOR SEAL 5020,PART #B60 VQ5021,PART B	178540	1	1	GL
HARDENER	HIT HY 20	182157	1	2	OZF
HARDENER	ITW RAMSET/RED HEAD EPCON SYSTEM GRANITE 5	179045	13	1	LB
HARDENER	JB WELD EPOXY STEEL HARDENER (PART A)	181148	1	1	OZF
HARDENER	RESINFUSION (TM) 8607	180695	1	1	GL
HARDENER (PART B)	DURALCO 4703 HARDENER	181615	3	1	OZF
HE-175 PETROLEUM OIL	HE-175 PETROLEUM OIL	15369	8	10	QT
HEAT SINK COMPOUND (FOR COMPLETE MSDS CALL X7380 OR X4788)	PLIOJIG CW1082A	179748	2	2	LB
HEAT SINK COMPOUND TYPE 9Z	COMPOUND, HEAT SINK, GENERAL	148088	1	8	OZN
HEAT TRANSFER COMPOUND	CHEMPLEX 1381-6/8OZ	182022	1	8	OZN
HEAT TRANSFER FLUID	DOWTHERM SR-1	148545	16	55	GL
HEAT-PROOF SILICONE ENAMELS	# 2807 ALUMINUM	148437	4	5	GL
HEET GAS LINE ANTIFREEZE	HA55120 - HEET GAS LINE ANTIFREEZE	181701	17	6	OZF
HELIUM	HELIUM	180328	10	219	CF
HELIUM	HELIUM	180582	1	125	LB
HELIUM	HELIUM	180639	2	291	CF
HELIUM	LIQUEFIED HELIUM (CRYOGENIC)	182060	1	8200	LR
HELIUM	LIQUEFIED HELIUM-HE, (CRYOGENIC)	182043	1	20	CF
HERBICIDE	52847 / DIMENSION ULTRA WSP HERBICIDE	182170	1	2.5	GL
HERBICIDE	75750 / DIMENSION HERBICIDE	182168	1	1	LB
HERBICIDE	DIREX 4L	181722	5	2.5	GL
HERBICIDE	HONCHO HERBICIDE	181975	8	2.5	GL
HERBICIDE	LESCO MOMENTUM PREMIUM SELECTIVE HERBICIDE	182171	1	2.5	GL
HERBICIDE	MILLENNIUM ULTRA SELECTIVE HERBICIDE	182169	1	2.5	GL
HERBICIDE	REGAL WYNSTAR	182176	4	10	LB

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
HERBICIDE	SAHARA DG HERBICIDE	180084	5	10	LB
HERBICIDE	SIMAZINE 4L FLOWABLE HERBICIDE	181539	1	2.5	GL
HERBICIDE	SNAPSHOT 2.5 TG HERBICIDE	181540	7	50	LB
HERBICIDE	TARGET 6 PLUS	182334	2	2.5	GL
HERBICIDE	WEEDONE BRAND LV4 HERBICIDE	181030	7	2.5	GL
HEXACHLOROBENZENE STANDARD	33231-520	181365	1	2500	ML
HEXANE	H2380	181443	1	4	LR
HEXANE	HEXANE/N-HEXANE/HEXYL HYDRIDE	181982	8	1	GL
HEXANE	HX0296	180471	12	4	LR
HEXANE	HX0296	181075	4	4	LR
HEXANE	HX0297	180022	3	4	LR
HEXANE, OMINISOLVE CHEMICAL	EM-HX0298-1	180362	7	4	LR
HEXANE, OMINISOLVE CHEMICAL	EM-HX0298-1	180832	1	4	LR
HFE-7100 3M NOVEC ENGINEERED FLUID	HFE-7100	181786	3	55	GL
HFE-7100 3M NOVEC ENGINEERED FLUID	HFE-7100	181787	6	55	GL
HH-66 VINYL CEMENT	HH-66 VINYL CEMENT	182052	1	8	OZN
HI-HIDE INTERIOR LATEX PASTEL BASE	105	181839	1	1	QT
HI-MIL SHER-TAR	B60V40	179823	2	1	GL
HI-MIL SHER-TAR	B60V40	179940	9	1	GL
HI-MIL SHER-TAR	B69B40	179822	2	3	GL
HI-MIL SHER-TAR	B69B40	179939	14	3	GL
HIGH ALKALINE OVER CLEANER/DEGREASER.	GREASECUTTER #17111	14907	1	8	OZN
HIGH ALKALINE PRESOAK DETERGENT	DECARBONIZER MXP STA	179569	1	8	LB
HIGH PURITY ALUMINA ADHESIVE	RESBOND 989/ALUMINA ADHESIVE	181890	1	1	QT
HIGH SPOT BLUE DYE	HI-SPOT BLUE BASE #107	180567	7	0.22	OZN
HIGH SPOT BLUE DYE	HI-SPOT BLUE BASE #107	180567	4	0.55	OZN
HIGH TEMP THREADLOCKER 27240	HIGH TEMP THREADLOCKER 27240	181847	1	1	ML
HOT MELT ADHESIVE	S-1251 / RED MASTIC, SEALANT	182281	50	1	LB
HPS CETIFIED WASTERWATER - CYANIDE	CAT NO. CWW-CN	179250	1	10	ML
HVAC AND WALL DISINFECTANT	FOSTER 40-80 DISINFECTANT	181662	2	5	GL
HYDRASOL CABLE GEL REMOVER	HYDRASOL CABLE GEL REMOVER	181734	15	1	PT
HYDRATED LIME	HYDRATED LIME	14851	1	10000	LB
HYDRAULIC CEMENT	BONSAL INSTANT HYDRAULIC CEMENT	181296	2	5	GL
HYDRAULIC FLUID	QUINTOLUBRIC 822-220	15430	1	55	GL
HYDRAULIC OIL	HYJET IV-A PLUS	181956	3	55	GL
HYDRAULLIC FLUID, PETROLEUM	ROYCO 756D(BEFORE AUGUST 1980)	98153	41	1	GL
HYDROCHLORIC ACID	CAT NO 508-212	148452	1	2.5	LR
HYDROCHLORIC ACID	CAT NO 508-212	180671	2	2.5	LR
HYDROCHLORIC ACID	HYDROCHLORIC ACID	24129	9	2.5	LR
HYDROCHLORIC ACID	HYDROCHLROIC ACID - MURIATIC ACID	148282	1	55	GL
HYDROCHLORIC ACID 37% SOLUTION	A508212	180360	1	1	LR
HYDROCHLORIC ACID 37% SOLUTION	A508212	180360	2	2.5	LR
HYDROCHLORIC ACID, 2.5 N	141832/HYDROCHLORIC ACID STANDARD SOLUTION, 2.5 N	181903	25	100	ML
HYDROFLUORIC ACID SOLUTION (70%)	HYDROFLUORIC ACID, AQUEOUS (70%)	180810	1	500	LB
HYDROGEN	HYDROGEN	15141	4	40	CF
HYDROGEN	HYDROGEN	15141	163	197	CF
HYDROGEN CHLORIDE	HYDROGEN CHLORIDE	179010	1	0.5	LB
HYDROGEN CYLINDER	HYDROGEN-H2	182337	1	10	CF
HYDROGEN IN HELIUM	HYDROGEN IN HELIUM	181521	6	195.8	CF
HYDROGEN PEROXIDE IN WATER	30-35% HYDROGEN PEROXIDE IN WATER	181958	1	500	ML
HYDROGEN PEROXIDE, 30%	5170	148598	2	250	ML
HYDROGEN SULFIDE	HYDROGEN SULPHIDE	182061	3	650	LR
HYDROGEN SULFIDE (H2S)	1810-0858-25PPM	181593	1	58	LR
HYDROGEN SULFIDE (H2S)	1810-0859-25PPM	180819	1	2	CF
HYDROGEN SULFIDE (H2S)	1810-0859-25PPM	180819	3	58	LR
HYDROGEN/NITROGEN GAS MIX	HYDROGEN/NITROGEN GAS MIX	181811	1	223	CF
HYDROLIC PHEN, SEALANT	32429 / LOCTITE(R) 545 THREAD SEALANT	182286	30	10	ML
HYDROQUINONE CRYSTAL	HYDROQUINONE CRYSTAL	182123	1	100	GM
HYDROQUINONE CRYSTALS	HYDROQUINONE CRYSTALS	182124	1	5	GM
HYDROXYLAMINE HYDROCHLORIDE, ACS	HYDROXYLAMINE HYDROCHLORIDE	180707	1	500	GM
HYPOCHLORITES	BIOGUARD BURN OUT WP	180371	3	12	LB
INDICATOR SOLUTION	PAN INDICATOR SOLUTION 0.3	180034	1	100	ML
INDUSTRIAL	1502 FLAT WHITE	179667	1	11	OZF
INDUSTRIAL	1508 WHITE SEMI-GLOSS ACRYLIC ENAMEL	181241	2	16	OZF
INDUSTRIAL BLACK	6170203	180479	2	1	GL
INDUSTRIAL GEAR OIL	MOBILGEAR 630	15115	2	55	GL
INDUSTRIAL PAINT REMOVER	REMOVALL 220	181964	4	1	GL

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
INDUSTRIAL POLYMER STICK (FOR COMPLETE MSDS CALL X7380/4788	POLY-QUICK STICK CW 1650	179749	2	2.5	LB
INDUSTRIAL POLYMER STICK (FOR COMPLETE MSDS CALL X7380/4788	POLY-QUICK STICK CW 1650	181690	2	2.5	LB
INDUSTRIAL POLYMER STICK (FOR COMPLETE MSDS CALL X7380/4788	POLY-QUICK STICK CW 1650	181690	19	4	OZN
INERT GAS	NITROGEN	14952	50	230	CF
INHIBITING COMPOUND	PENETROX PEN-E OXIDE INHIBITING COMPOUND	180677	3	8	OZF
INSECT KILLER	PURGE III INSECT KILLER	178763	1	0.2	KG
INSECT KILLER	PURGE III INSECT KILLER	178763	66	6.25	OZF
INSECT REPELLENT AEROSOL	53655 / UNSCENTED BACKWOODS CUTTER INSECT REPELLENT	182278	40	6	OZN
INSECT REPELLENT II	DEEP WOODS OFF II	148201	4	1	OZN
INSECT REPELLENT II	DEEP WOODS OFF II	148201	11	12	OZN
INSECTICIDE	02-0565-3 / PRESCRIPTION TREATMENT BRAND P.I. CONTACT INSECT	182163	19	18	OZF
INSECTICIDE	CATALYST EMULSIFIED IN H20 INSECTICIDE	178767	1	64	OZF
INSECTICIDE	CATALYST EMULSIFIED IN H20 INSECTICIDE	179829	2	64	OZF
INSECTICIDE	DELTAGARD GC 5SC INSECTICIDE	182267	1	1	GL
INSECTICIDE	DOWELANCO DURSBAN PRO	178761	16	1	PT
INSECTICIDE	SIEGE GEL INSECTICIDE	180907	1	30	GM
INSECTICIDE	SUSPEND SC INSECTICIDE	181265	24	1	PT
INSECTICIDE GRANULES	CHIPCO CHOICE/TOPCHOICE INSECTICIDE GRANULES	181981	1	50	LB
INSPECTION PENETRANT REMOVER	SKC-S SPOTCHECK CLEANER/REMOVER	14594	122	10	OZF
INSPECTION PENETRANT REMOVER	SKC-S SPOTCHECK CLEANER/REMOVER	14594	1	12	OZF
INSULATING FOAM	TOUCH 'N FOAM ALL-DIRECTION DESPENSING TRIPLE EXPANDING	182321	19	16	OZN
INSULATING VARNISH,ELECTRICAL	GLYPTAL	119932	1	12	OZF
INSULATION	TOUCH'N FOAM EXP. HOLE FILLER, REDDY	181046	15	12	OZF
INSULATOR CLEANER	240	179929	12	1	QT
INTERNAL BOILER TREATMENT	OPTISPERSE SP531	180554	11	280	LB
INTERNATIONAL ORANGE ENAMEL	F65E37	14601	3	1	GL
IRON CLEANER	RUSTPHREE 73924	181965	1	55	GL
ISOBUTANE-C4H10	ISOBUTANE-C4H10	181955	2	22	CF
ISOBUTYLENE	ISOBUTYLENE	181757	1	3.6	CF
ISOBUTYLENE CYLINDER	18102939 / 100 PPM ISOBUTYLENE	182261	1	200	ML
ISOCYANATE ACTIVATORS, HARDENERS, AND ADDITIVES	ISOCYANATE ACTIVATORS, HARDENERS, AND ADDITIVES	182048	1	4	OZF
ISOPROPYL ALCOHOL	ISOPROPYL ALCOHOL 99% PRODUCT CODE 04911	148264	1	0.625	GL
ISOPROPYL ALCOHOL	ISOPROPYL ALCOHOL 99% PRODUCT CODE 04911	148264	109	1	GL
ISOPROPYL ALCOHOL	ISOPROPYL ALCOHOL 99% PRODUCT CODE 04911	148264	1	3	GL
ISOPROPYL ALCOHOL	ISOPROPYL ALCOHOL 99% PRODUCT CODE 04911	148264	2	4	GL
ISOPROPYL ALCOHOL	ISOPROPYL ALCOHOL 99% PRODUCT CODE 04911	148264	4	5	GL
ISOPROPYL ALCOHOL	ISOPROPYL ALCOHOL 99% PRODUCT CODE 04911	148264	1	16	OZF
ISOPROPYL ALCOHOL	ISOPROPYL ALCOHOL 99% PRODUCT CODE 04911	148264	4	55	GL
ISOPROPYL ALCOHOL	ISOPROPYL ALCOHOL 99% PRODUCT CODE 04911	148264	2	320	ML
ISOPROPYL ALCOHOL	PX1834-1	180833	3	1	LR
ISOPROPYL ALCOHOL	PX1834-1	180833	7	4	LR
ITEM NO. 27121	271 ADHESIVE/SEALANT	148287	15	1	OZF
ITEM NO. 27121	271 ADHESIVE/SEALANT	148287	1	50	ML
JAPAN DRIER	GJD40	178688	1	1	PT
JETWELD	JETWELD LH-70	147903	1	50	LB
JOINT COMPOUND	TITE SEAL GASKET/JOINT CMPD 1/T1-01-03-03V	27856	2	12	OZN
JP-10	JP-10	182205	54	55	GL
JP-4 MILITARY FUEL STANDARD	JP-4 MILITARY FUEL STANDARD	181913	1	5	ML
JP-4 STANDARD	JP-4 MILITARY FUEL STANDARD	181754	4	10000	ML
K-1 KEROSENE	K-1 KEROSENE	14646	10	1	GL
K-1 KEROSENE	K-1 KEROSENE	14646	5	5	GL
K-1 KEROSENE	K-1 KEROSENE	14646	35	55	GL
K120 THINNER	R7K120	180962	1	1	GL
KEROSENE FLASH POINT STANDARD	AR3027	179977	1	500	ML
KEROSENE FUEL COMPOSITE STANDARD	KEROSENE FUEL COMPOSITE STANDARD	181914	1	5	ML
KF PYRIDENE FREE VESSEL SOLUTION	PHOTOVOLT KF PYRIDINE FREE VESSEL SOLUTION	181891	1	200	ML
KIT	ARC 855B (PART A), ARC 855G (PART A)	179992	1	1	KG
KIT	ARCH 855B (PART B), ARC 855G (PART B)	179993	1	1	KG
KODAK DURAFLO RT DEVELOPER REPLINSHER - PART B	102 3308	180126	2	5	GL
KODAK FIXER P ARTS A&B	139-7231	181789	19	6	GL
KODAK PROFESSIONAL FILM CEMENT	195 6150, 195 6176	179494	2	1	PT
KODAK RAPID FIXER	146 4106	180143	3	1	GL

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
KODAK VNF-1/RVNP FIRST DEVELOPER STARTER	100 3607/ KODAK VNF-1/RVNP FIRST DEVELOPER STARTER	181433	11	12	OZF
KONTACT RESTORER 2000	ES1628	181025	7	16	OZF
KROMIK B50NZ6	KROMIK B50NZ6	8457	1	1	GL
KRUD KUTTER	KRUD KUTTER	180430	19	16	OZF
KRUD KUTTER	KRUD KUTTER	180430	85	32	OZF
KRUD KUTTER	KRUD KUTTER	180914	61	1	GL
KRYLON HIGH-TEMP PAINT	08102 HIGH-TEMP BLACK	180886	18	12	OZF
KRYLON HOME DECOR DURABLE LATEX SPRAY SATIN BLACK	7401	181507	8	10	OZF
KRYLON KID'S TUFF ENAMEL, SNOW WHITE	7500	181506	26	10	OZF
KWIK FOAM	18230, 18232/KWIK FOAM	182001	16	24	OZF
KYRLON HIGH HEAT & RADIATOR PAINT, WHITE	1505	180897	11	12	OZF
L-P # 250/ ANTI-SEIZE THREAD COMPOUND	L-P # 250/ ANTI-SEIZE THREAD COMPOUND	182053	2	8	OZF
L/C B/N LAB CONTROL SAMPLE A	31241A, 31241A-5XX & 31341A	180732	1	5	ML
LAB CONTROL SAMPLE	30093, 30093-5XX & 30193 /LC VOA LAB CONTROL SAMPLE #2	181555	1	10	ML
LAB CONTROL SAMPLE	LC/VOA LAB CONTROL SAMPLE #1	181912	1	5	ML
LABORATORY REAGENT	BORON 1,000 UG/ML (0.10% W/V)	157535	1	100	ML
LABORATORY STANDARD CHEMICAL	32030 / DECACHLOROBIPHENYL MIX	182165	1	5	ML
LACQUER	MICCROSTOP	182167	1	1	GL
LACQUER	OMEGALAQ-175G	182331	1	2	OZN
LACQUER	OMEGALAQ-225G	182330	1	2	OZN
LACQUER GREEN 14491, AEROSOL	SO-SURE GREEN 14491 (14-145)	6740	1	0.7	OZF
LACQUER THINNER	LACQUER THINNER 861	181487	7	1	GL
LACQUER THINNER	R7 K 22	180575	52	1	GL
LACQUER, WHITE 37875, AEROSOL	SO-SURE FLAT WHITE SPRAY PAINT 37875 (94-370) P/N 92C870	178851	1	0.37	KG
LACTIC ACID	LACTIC ACID	180555	1	500	ML
LATEX	A82 Y 516 BASE B	179875	2	1	GL
LATEX ADHESIVE	HENRY 440 COVE BASE ADHESIVE	182025	1	30	OZN
LATEX CAULK	PRO'S SELECT SILICONIZED ACRYLIC LATEX CAULK	179417	4	10	OZF
LATEX ENAMEL, GLOSS BLACK	7908/ECO-GUARD LATEX ENAMEL GLOSS BLACK	181948	48	12	OZF
LATEX FLAT INTERIOR FINISHES	A27 W11 CLASSIC 99 FLAT	148217	1	1	GL
LATEX FLAT INTERIOR FINISHES	A27 W12 CLASSIC 99 FLAT	148219	1	1	GL
LATEX FOAM SEALANT	DAPTEX LATEX FOAM SEALANT	181558	17	12	OZF
LATEX INTERIOR PAINT	5751	178939	1	99.4	OZF
LATEX PAINT	PP2905(0878)/PORTER GUARD DTM GLOSS W	182366	2	1	GL
LATEX STAIN	108-1033	180887	25	1	GL
LAYOUT DYE	LAYOUT DYE, BLUE	179921	2	8	OZF
LAZER DYE	32226 / DABCO	182296	1	10	GM
LIGHT STICK	ACTIVATED CHEMILUNINESCENTPRODUCT/LIGHT STICK	182110	1	6	LB
LIQUEFIED NITROGEN N2 (CRYOGENIC)	LIQUEFIED NITROGEN N2 (CRYOGENIC)	182030	2	300	CF
LIQUID ANTIFOAM	4LAFL.PTS / LESCO RECEDE	182219	7	16	OZF
LIQUID BUFFER	LIQUID BUFFER	180594	2	14	OZF
LIQUID BUFFER	PRODUCT #12-092	148496	1	32	OZF
LIQUID CLEANER	LIQUID ORANGE AL	180571	11	5	GL
LIQUID DECK WASH	158 0489	179460	3	1	GL
LIQUID FLUX	GENERAL PURPOSE LIQUID SOLDERING FLUX	182218	8	16	OZF
LIQUID HARDENER	LIQUID HARDENER	182127	3	2	OZN
LIQUID ICE MACHINE CLEANER	LIQUID ICE MACHINE CLEANER	180092	3	8	OZF
LIQUID NAILS FOR PROJECTS AND CONSTRUCTION	LN-601	180990	4	10.5	OZF
LIQUID PETROLEUM GAS	LP GAS PROPANE (ODORIZED)	179679	1	1065	GL
LIQUID PETROLEUM GAS	LP GAS PROPANE (ODORIZED)	180283	1	85	GL
LIQUID SOLVENT	POSITRON DIELECTRIC SOLVENT	182213	4	4	GL
LIQUID SOLVENT CLEANER	GOOF OFF	181835	23	16	OZF
LOCKWELD 600 CONTACT ADHESIVE	MSDS # 106	179249	1	1	GL
LOCQUIC PRIMER	7649/LOCQUIC PRIMER N	181999	1	1.75	OZF
LOCTITE 4471 INSTANT ADHESIVE PRISM	LOCTITE 4471 INSTANT ADHESIVE PRISM	181798	7	20	GM
LOCTITE 680 RETAINING COMPOUND	68015/LOCTITE 680 RETAINING COMPOUND SLIP FIT	182000	1	10	ML
LOCTITE 7659 PRIMER N	19269 LOCTITE 7649	181926	10	1.75	OZF
LOCTITE CHISEL GASKET REMOVER	79040	181660	6	18	OZF
LOCTITE PNEUMATIC/HYDRAULIC 545 THREAD SEALANT	54531	181669	11	50	ML
LOCTITE(R) 290 THREADLOCKER WICKING GRADE	29031	181621	56	50	ML

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
LOCTITE(R) ASSURE (TM) 425 INALENT ADHESIVE	42540	181823	1	20	GM
LOCTITE(R) PST(R) THREAD SEALANT	56541	181622	9	250	ML
LOV-606, HI GLOSS VINYL COLORS	LOV-606, HI GLOSS VINYL COLORS	76377	1	1	QT
LOW SULFUR KEROSINE	01464 1-K	179376	7	5	GL
LOW SULFUR KEROSINE	01464 1-K	179376	13	55	GL
LPS 2 INDUSTRIAL STRENGTH LUBRICANT	00216/02128/00205/00255/00222	178565	3	11	OZF
LPS 3 HEAVY-DUTY RUST INHIBITOR	00316	181624	76	11	OZF
LPS CHAINMATE	PART NO. 02416	148402	9	1	PT
LPS ELECTRO 140 CONTACT CLEANER	00916, 09128, 00905, 00955	180652	71	11	OZF
LPS FORCE 842 DRY MOLY LUBRICANT	02516	181542	5	11	OZF
LPS POWER SHOT WASP & HORNET SPRAY	04420	180611	45	14	OZF
LPS QB PRECISION DUSTER	05710	179907	25	10	OZF
LPS TAPMATIC #1 GOLD - AEROSOL	40304/40320/40330/40340/40360/40312/	178745	5	1	PT
LPS TAPMATIC DUAL ACTION #1 GOLD	LPS TAPMATIC DUAL ACTION #1 GOLD	148766	27	16	OZF
LPS TAPMATIC DUAL ACTION #1 GOLD	LPS TAPMATIC DUAL ACTION #1 GOLD	181334	11	16	OZF
LPS TAPMATIC EDGE LUBE	43200	180644	3	13	OZF
LPS TAPMATIC TRIPLE E	LPS TAPMATIC TRIPLE E	148431	24	1	PT
LST PENETRANT	01916/09128/01905/09155	179338	8	11	OZN
LUBRICANT	35201G / CHAIN AND CABLE LUBE	182160	52	12	OZN
LUBRICANT	37229 / C5A ANTISEIZE STICK	182325	20	2	OZN
LUBRICANT	5901 / LOK-CEASE AEROSOL	182187	2	15	OZF
LUBRICANT	C5-A (51007)	148390	104	1	LB
LUBRICANT	C5-A (51007)	181910	12	1	LB
LUBRICANT	C5-A (51007)	181910	6	4	OZN
LUBRICANT	C5-A (51009)	14781	2	8	LB
LUBRICANT	HOUDINI LUBRICANT	180935	28	11	OZN
LUBRICANT	NORDSTROM 234 SEALANT (BULK GRADE)	181603	6	5	LR
LUBRICANT	NORDSTROM 234 SEALANT (BULK GRADE)	181603	16	5.3	OZF
LUBRICANT	NORDSTROM 234 SEALANT (BULK GRADE)	181603	15	5.3	OZN
LUBRICANT	S00200 DRY MOLY LUBE	180021	5	16	OZF
LUBRICANT	TIOLON X-20 AREOSOL	181759	8	12	OZN
LUBRICANT FOR 2 CYCLE ENGINES	OPTI-2 2 CYCLE LUBRICANTS	15097	1	1.8	OZF
LUBRICANTS	00200 DRY MOLY LUBE	14580	11	16	OZF
LUBRICATING OIL	33-310 CITGO TRACTOR HYDRAULIC FLUID	147892	2	55	GL
LUBRICATING OIL	CITGO PREMIUM OIL GEAR (MP) 80W90 31-310	147661	8	55	GL
LUBRICATING OIL, VACUUM PUMP OIL	704 DIFFUSION PUMP OIL (INVOIL)	125707	1	0.04	GL
LUBRICATING OIL, VACUUM PUMP OIL	704 DIFFUSION PUMP OIL (INVOIL)	125707	14	0.06	GL
LUBRICATING OIL, VACUUM PUMP OIL	704 DIFFUSION PUMP OIL (INVOIL)	125707	7	1	GL
M-COAT A	M-COAT A	179428	1	1	OZF
M-FLUX AR	M-FLUX AR	181337	2	1	OZF
M-LINE ROSIN SOLVENT	M-LINE ROSIN SOLVENT	181336	5	1	OZF
M-PREP CONDITIONER A	M-PREP CONDITIONER A	182343	1	16	OZF
MACHINE CLEANER	INTERNATIONAL MACHINE CLEANER 550-LF	180337	3	55	GL
MAGIC BOND EPOXY STICK-GREEN, WHITE, ALUM, COPPER, BLUE	11600	180310	6	4	OZF
MAGIC KOTE	MAGIC KOTE	179273	1	55	GL
MAGNAGLO MAGNETIC PARTICLE 14A	MAGNAGLO MAGNETIC PARTICLE 14A	180399	1	1	LB
MAGNESIUM CHLORIDE, HEXAHYDRATE	MAGNESIUM CHLORIDE, HEXAHYDRATE	181130	1	3	KG
MAGNESIUM CHLORIDE, HEXAHYDRATE	MAGNESIUM CHLORIDE, HEXAHYDRATE	181130	1	500	GM
MANOR HALL EXT WHITE	79-45	182036	7	1	GL
MARATHON PAINT	MARATHON 1030	181674	5	1	QT
MARINE TEX CATALYST JELLY	3001H (PART B)	181527	1	7	OZN
MARINE TEX GREY RESIN	3001U, 3003U, 3005U (PART A)	181526	1	3	LB
MARKING PAINT	16-622	180279	100	12	OZF
MARKING PAINTS	PRODUCT #'S 16-604 THRU 16-624, 16-692 THRU 16-652, 20-632,	148513	27	12	OZN
MASKING MATERIAL	MICCROSHIELD	182166	1	1	GL
MASTER WINDSHIELD DEICER	WD-16	180045	1	12	OZF
MASTIC ALUMINUM II	B60V100 HARDENER PART B	178602	6	1	GL
MASTIC ALUMINUM II	B60V100 HARDENER PART B	178842	5	1	GL
MASTIC ALUMINUM II	B62S100 PART A	178587	16	1	GL
MASTIC ALUMINUM II	B62S100 PART A	178841	4	1	GL
MATRIX MODIFIER	MM-9100	180839	1	100	ML
MCLUBE MOS2-99	MCLUBE MOS2-99	14676	2	10	OZN
MEDICAL OXYGEN	OXYGEN	15189	2	22	CF
MEGA STAINLESS STEEL	STAINLESS STEEL COATING	182098	6	6	OZF
MEGASEAL NSP GRAY	99-6511	181814	11	1	GL
MEGASEAL PAINT	99-6511/ GRAY EPOXY ANTI SLIP	182289	32	1	GL

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
MEMBRANE CLEANING CARTRIDGE	C-C2520-A22 / ALKALINE TF TYPE RO MEMBRANE CLEANING CARTRIDG	182293	1	2	LB
MERCON WIPES	20-MWIPE-70/MERCON WIPES	182011	1	1	LB
MERCURIC NITRATE	LC16657	180474	1	500	ML
MERCURY CHECK SWABS	MERCURY CHECK SWABS	181934	1	6	OZN
METAL ALLOY POWDER (FOR COMPLETE MSDS CALL 7380 OR 4788)	PYROSPRAY 440	179704	2	1	LB
METAL ALLOY POWDER (FOR COMPLETE MSDS CALL 7380 OR 4788)	PYROSPRAY 820	179698	4	1	LB
METAL ALLOY POWDER (FOR COMPLETE MSDS CALL 7380 OR 4788)	PYROSPRAY 830	179699	2	1	LB
METAL ALLOY POWDER (FOR COMPLETE MSDS CALL 7380 OR 4788)	PYROSPRAY 840	179700	2	1	LB
METAL ALLOY POWDER (FOR COMPLETE MSDS CALL 7380 OR 4788)	PYROSPRAY 850	179701	2	1	LB
METAL ALLOY POWDER (FOR COMPLETE MSDS CALL 7380 OR 4788)	PYROSPRAY 860	179702	2	1	LB
METAL ALLOY POWDER (FOR COMPLETE MSDS CALL 7380 OR 4788)	PYROSPRAY 880	179703	2	1	LB
METALATEX SEMI-GLOSS COATING, MIDTONE BASE	B42W102	15195	3	1	GL
METALATEX SEMI-GLOSS COATING, MIDTONE BASE	B42W102	180574	5	1	GL
METALATEX* SEMI-GLOSS COATING, ULTRADEEP BASE	B42T104 METALATEX	15194	3	1	GL
METALLIC INK	CL11-5349 / METALLIC CONDUCTIVE INK	182225	1	20	GM
METALWORKING FLUID CONCENTRATE	VALCOOL TURN TECH	181387	8	55	GL
METHANE	METHANE	181756	1	3.6	CF
METHANE CYLINDER	18102312 / 99% METHANE	182262	2	200	ML
METHANOL	METHANOL	148209	1	4	LR
METHANOL	METHANOL	148251	3	4	LR
METHANOL	MX0484	180317	23	1	LR
METHANOL	MXO486-6	179660	3	1	LR
METHANOL	MXO486-6	180941	3	6	LR
METHANOL	MXO488P-1	180987	8	4	LR
METHANOL,TECHNICAL	METHANOL	147798	8	4	LR
METHYL ALCOHOL	MX0488	178568	4	4	LR
METHYL ETHYL KETONE,TECHNICAL	METHYL ETHYL KETONE	104884	9	1	GL
METHYL ETHYL KETONE,TECHNICAL	METHYL ETHYL KETONE	104886	10	1	GL
METHYL N-AMYL KETONE	METHYL N-AMYL KETONE	179007	1	23	GL
METHYL N-AMYL KETONE	METHYL N-AMYL KETONE	179007	1	55	GL
METHYLENE CHLORIDE	31622 / 8270 CALIBRATION MIX	182241	1	2500	ML
METHYLENE CHLORIDE	DICHLOROMETHANE	14561	1	0.94	PT
MICROBIOCIDE	TOWERBROM 960	181260	1	2370	LB
MIDTONE BASE	B33W202 (BASE Y)	179330	4	1	GL
MIDTONE BASE DTM ACRYLIC GLOSS COATING	B66W102	147856	83	1	GL
MINERAL SPIRITS	MR1 K4	180576	6	1	GL
MINERAL SPIRITS NONEXEMPT	MINERAL SPIRITS NONEXEMPT	14639	5	1	GL
MINWAX WOOD FINISH 245--GOLDEN PECAN	MINWAX WOOD FINISH 245--GOLDEN PECAN	181402	2	1	QT
MINWAX WOOD FINISH 2716--DARK WALNUT	MINWAX WOOD FINISH 2716--DARK WALNUT	181403	2	1	QT
MIRROR ADHESIVE	REAR VIEW MIRROR ADHESIVE, 765-1168 (11067)	181800	2	3	OZN
MIXTURE	A-1025 HELIUM MIXTURE	180326	20	247	CF
MOBILMET SIGMA, CUTTING OIL	MOBILMET SIGMA, CUTTING OIL	181429	1	55	GL
MODIFIED EXPOXIDE RESIN	BELZONA 1111 (BASE)	180410	9	1	KG
MOISTURE CURE URETHANE COATING	AEROGLAZE A276 GLOSS WHITE	181792	1	1	QT
MOISTURE CURE URETHANE COATING	AEROGLAZE Z306 FLAT BLACK	181795	4	1	QT
MOISTURE-CURE, POLYURETHANE PAINT	MC-MIOZINC 2.8	179335	1	5	GL
MOLDING COMPOUND	BUEHLER KONDUCTOMET	181675	1	1	LB
MONODODIUM PHOSPHATE ANHYDROUS/MONOHYDRATE	AST 10024	181976	3	50	LB
MORTAR MIX	EMACO T430 (FORMERLY RT 18)	181689	3	55	LB
MOTORVAC, DETERGENT FOR INDUSTRIAL DIESEL TUNE	PART #400-0010 DETERGENT	179325	12	16	OZF
MP FLUID ELASTOMER (BASE)	1017/1281 BELZONA 2221 (PART C)	181330	3	515	GM
MP HI-BUILD ELASTOMER (BASE)	1017/1237 BELZONA 2211	181327	1	389	GM
MP HI-BUILD ELASTOMER (SOLIDIFIER)	1117-1238 BELZONA 2211 (PART B)	181326	2	389	GM
MULTI-PURPOSE INDUSTRIAL SOLVENT	SOYGOLD 1000 SOLVENT	179912	1	1	PT
MULTIPURPOSE CLEANER	BOSS MULTIPURPOSE CLEANER	181601	1	0	GL
MULTIPURPOSE CLEANER	BOSS MULTIPURPOSE CLEANER	181601	65	1	GL

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
MULTIPURPOSE CLEANER	BOSS MULTIPURPOSE CLEANER	181601	14	32	OZN
MULTIPURPOSE CLEANER	BOSS MULTIPURPOSE CLEANER	181601	3	55	GL
MURIACTIC ACID	MURIACTIC ACID	181216	2	1	GL
N-BUTYL ACETATE	123-86-4, 1-BUTYL ACETATE	182058	1	4	LR
N-HEXANE	N-HEXANE	179344	5	4	LR
N-PENTANE	PX0167-1	181657	1	1	LR
N-PENTANE	PX0167-1	181657	1	4	LR
NALCO 1336	NALCO 1336	181970	1	15	GL
NATURALIZER AEROSOL	NATURALIZER AEROSOL	148191	6	12	OZF
ND VIBRA-TITE FORMULA #3	ND VIBRA-TITE FORMULA #3	148647	10	30	CC
NEON	LIQUEFIED NEON-NE, (CRYOGENIC)	182042	2	7500	LR
NEON	NEON	180953	2	2	LB
NEUTRALIZER	KOLORSAFE LIQUID ACID NEUTRALIZER	180648	1	1	QT
NEUTRALIZER	M-PREP NEUTRALIZER 5A	181133	1	500	ML
NEUTRALIZER	M-PREP NEUTRALIZER 5A	182342	1	16	OZF
NEVER-SEEZ	NS-168	180002	3	1	LB
NEXTEL GRAY PRIMER	911-P4	148691	2	1	GL
NICKEL PENETRATE	NICKEL PENETRATE	181557	2	500	LB
NITRIC ACID	A509SK212	180716	5	1	GL
NITRIC ACID	EM-NX0407-2	180949	6	1	LR
NITRIC ACID	NITRIC ACID	148292	4	2.5	LR
NITRIC ACID	NITRIC ACID A-509-212	148738	3	2.5	LR
NITRIC ACID	NITRIC ACID, ACS GRADE (USE TO BE ALLIED SIGNAL'S PRODUCT)	179995	12	55	GL
NITRIC ACID REAGENT GRADE	PRODUCT CODE:03810	147893	36	7	LB
NITRIC ACID SOLUTION 1:1	254049/NITRIC ACID SOLUTION 1:1	181904	1	2	ML
NITRIC OXIDE CYLINDER	NITRIC OXIDE - NO	182328	1	250	CF
NITROGEN	NITROGEN	180338	60	230	CF
NITROGEN	NITROGEN DIOXIDE 25 PPM	181059	1	25	CC
NITROGEN	NITROGEN DIOXIDE 25 PPM	181059	1	25	CZ
NITROGEN AND OXYGEN CYLINDER	NITROGEN AND OXYGEN MIX	182344	1	200	CF
NITROGEN CYLINDER	NITROGEN	182329	1	250	CF
NITROGEN DIOXIDE IN AIR	NITROGEN DIOXIDE IN AIR	181733	1	144	CF
NITROUS ACID, SODIUM SALT	SODIUM NITRITE	181977	4	50	LB
NO MARK	NO MARK	179521	1	14	OZF
NO. 2 FUEL OIL	247515-U	180849	1	1	ML
NO. 2 FUEL OIL	247515-U	181108	10	1	ML
NOA 81	NORLAND OPTICAL ADHESIVE 81	181239	8	6	GM
NOKORODE REGULAR PASTE FLUX	7698A1,2 (14030)	181592	1	1	LB
NON FLAMMABLE GAS MIX	NON FLAMMABLE GAS MIX/NO2; O2; N2	181938	3	2	CF
NON FLAMMABLE GAS MIXTURE	N/A	181824	5	103	LR
NON-FLAMMABLE CALIBRATION GAS MIXTURE	NON-FLAMMABLE CALIBRATION GAS MIXTURE	182018	1	2	CF
NON-FLAMMABLE CALIBRATION GAS MIXTURE	NON-FLAMMABLE CALIBRATION GAS MIXTURE	182019	2	14.1	CF
NON-FLAMMABLE GAS MIXTURE	50023	182035	2	2	CF
NONFLAMMABLE GAS MIXTURE	3 PPM-2.3% NITROGEN DIOXIDE/NITROGEN	182335	1	200	CF
NOVA CEALN FLOOR CLEAN	NOVA CLEAN FLOOR CLEAN	181058	4	1	GL
NOVOID X	NOVOID X (G & W SPEC. #222)	181692	10	5	GL
NOX RUST X110	MIL-C-16173E	181561	1	5	GL
O-TERPHENYL MIX	31097, 31097-5XX & 31197	180730	1	5	ML
OATEY ALL PURPOSE CEMENT	30818,30821,30834, 30847, 30848	181821	8	1	QT
OATEY ALL PURPOSE CEMENT	PRODUCT NO. 30818, 30821	148506	77	8	OZN
OATEY CLEANER	30779, 30782, 30795, 30805, 30766	14661	13	16	OZF
OATEY CLEANER	30779, 30782, 30795, 30805, 30766	179025	1	1	QT
OATEY CLEANER	30779, 30782, 30795, 30805, 30766	181820	5	1	QT
OATEY MEDIUM CLEAR PVC CEMENT	31019	181583	2	16	OZF
ODG-FREE DEGREASER	22355	181925	8	6	OZF
OIL	01-2122-45 / OIL	182132	1	55	GL
OIL BASE VARNISH	A66 F 90 HAND RUBBER SATIN	14790	3	0.25	GL
OIL BASE VARNISH	A66 F 90 HAND RUBBER SATIN	14790	1	1	GL
OIL STAIN	OIL STAIN	179477	1	1	GL
OIL,HONING VSG-20657 SEAT CUTTING OIL	MB-30-5 HONING OIL & MB-30-55 HONING OIL	14050	1	55	GL
OPEX GLOSS WHITE	L61W34	178782	4	0.5	GL
OPEX GLOSS WHITE	L61W34	178782	1	1	GL
OPEX L61 PRODUCTION LACQUER	L61L31 - RICH BLUE	15181	1	1	GL
OPEX L61 PRODUCTION LACQUER	L61L31 - RICH BLUE	15181	1	1	QT
OPEX L61 PRODUCTION LACQUER	L61R44 (RED)	178683	1	1	GL
OPEX LACQUER	M60 B 16 DEAD FLAT BLACK	147755	1	1	GL
OPEX LACQUER PRIMER	P61W1 OPEX LACQUER PRIMER-SURFACER WHITE	14788	2	1	GL

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
OPTISPERSE	AP301	181498	3	265	LB
ORANGE	F-900 TORQUE SEAL	181438	12	4	OZF
ORGANIC	A11825A / PRIMO MAXX	182173	1	2.5	GL
ORGANIC	MULTIGREEN II	182193	1	1	GL
ORGANOCHLORINE PESTISIDE MIX AB#1	32391	181364	1	2500	ML
OSHA RED	F61110	179617	3	12	OZF
OSPHO METAL TREATMENT	OSPHO METAL TREATMENT	180892	1	1	GL
OXADIAZON	QUALI-PRO OXADIAZON 50 WSB	182221	65	2	LB
OXYGEN	OXYGEN	15134	32	20	CF
OXYGEN	OXYGEN	15168	18	124	CF
OXYGEN	OXYGEN	180331	38	22	CF
OXYGEN	OXYGEN	180332	162	251	CF
OXYGEN	OXYGEN	180357	59	20	CF
OXYGEN	OXYGEN	181818	310	251	CF
OXYGEN CYLINDER	OXYGEN	182310	1	150	CF
OXYGEN FILLING SOLUTION	05566-51	180687	1	64	OZF
OXYGEN, COMPRESSED GAS	OXYGEN, COMPRESSED GAS	181776	1	2	CF
OXYGEN/NITROGEN GAS BLEND	25% OXYGEN/ BALANCE NITROGEN GAS BLEND	181887	1	200	CF
PAINT	0000200644 / ATHLETIC FIELD MARKER-WHITE	182208	36	16	OZN
PAINT	102L,1 SHOT LETTERING ENAMEL	29782	1	1	PT
PAINT	108L,1 SHOT LETTERING ENAMEL	29783	1	1	QT
PAINT	132L,1 SHOT LETTERING ENAMEL	29786	2	1	PT
PAINT	150L,1 SHOT LETTERING ENAMEL	29790	1	1	QT
PAINT	158L,1 SHOT LETTERING ENAMEL	27983	1	1	PT
PAINT	894 SPRED URETHANE FL-EN CHATEAU G	44917	1	3.475	KG
PAINT	95-2402 / PITT-GUARD RAPID-COAT YELLOW BASE	182303	4	1	GL
PAINT	A-A-1801 TAN, SOLVENT BASED OBLITERATING COMPOUND	182252	2	12	OZN
PAINT	A-A-2068 TYPE III, BLACK 37038	182254	1	12	OZN
PAINT	C20 L 12 KEM BULLETIN COLOR 158 DARK BLUE	45841	2	1	GL
PAINT	C20 W 1 KEM BULLETIN WHITE	45845	2	1	GL
PAINT	GLID-GUARD ALKYD INDUSTRIAL ENL 4540	34516	1	1	GL
PAINT	POLYURETHANE AEROSOL COLORS	181599	7	16	OZF
PAINT	TT-E-516A, GREEN 34088	182253	2	12	OZN
PAINT & VARNISH REMOVER	SUPERSTRIP PAINT & VARNISH REMOVER	14559	32	1	GL
PAINT OIL	PENETROL/MARINE PENETROL	14789	26	1	GL
PAINT REMOVER	102602 STRIP-X	15353	7	2	OZF
PAINT REMOVER	HARVEY'S ORGANIC POWER PAINT STRIPPER GEL	178866	1	32	OZF
PAINT REMOVER	SOY-GEL	181855	29	1	GL
PAINT REMOVER	SOY-GEL	181855	12	5	GL
PAINT STRIPPER	574 PAINT STRIPPER	179034	1	0.98	KG
PAINT STRIPPER	D-ZOLVE GL 15-33	181292	1	5	GL
PAINTER'S ACRYLIC LATEX CAULK(FOR COMPLETE MSDS 7380/4788	5E079	179752	8	10.1	OZF
PAN SEALANT	PPA	181799	12	14	OZF
PART # 5R151, 5R153, 5R408, 5R525 (XCI)	3300/4045/XP10 MAGNETIC DEVELOPER	14711	1	12	OZF
PART A	855 ABRASION CONTROL LIQUID	15063	2	4.5	KG
PART A - HARDENER	TRA-BOND 2151	181649	2	0.75	OZF
PART A - RESIN	PLASTIC STEEL LIQUID (B) RESIN	181698	12	1	LB
PART B	SIKAFLEX 2C, NS PART B	181724	15	1	GL
PART B (HARDENER)	DURALCO 4525	181617	2	3	OZF
PART B EPOXY COATING	SHELCOTE II CATALYST PART B 700-C-764	178544	1	1	GL
PART B EPOXY HARDENER	LIQUID HARDENER 0202	181699	10	3	OZF
PART NO 0296	ELECTRON DIELECTRIC SOLVENT	148208	12	22	OZN
PASTE POLISH COMPOUND	SIMICHROME POLISH	182266	6	8.82	OZN
PATCH CRACK MATERIAL	PLISTIX SR-68	181863	2	50	LB
PATCH CRACK SERVICING MIX	PLISTIX SR-68	182247	1	50	LB
PAVEMENT SEALER	15000 SERIES / PAVEMENT SEALER	182010	3	5	GL
PC9215A PORTER THANE 9200 URETHANE ENAMEL, W	PART A PC9215A ACRYLIC	182082	5	14	OZF
PC9244A, ACRYLIC	PC9244A PORTER THANE 9200 URETHANE ENAMEL, N	182083	1	1	GL
PEACOCK BLUE	59152	178979	1	1	QT
PENETRATING OIL	KROIL	14943	1	0.05	PT
PENETRATING OIL	KROIL	14943	13	0.06	GL
PENETRATING OIL	KROIL	14943	10	0.13	GL
PENETRATING OIL	KROIL	14943	9	1	PT
PENETRATING OIL	KROIL	14943	1	7.7675	GL
PENETRATING OIL	KROIL	14943	5	15	GL
PENTACHLOROPHENOL-PFB SOLUTION	EPM80460	180865	1	5	ML
PENTANE AND ISOMERS CYLINDER	PENTANE AND ISOMERS	182077	1	214	CF

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
PERMANENT THREADLOCKER 262	26231-5E215	180792	33	10	ML
PERMANENT THREADLOCKER 262	26231-5E215	180792	4	50	ML
PERMATEX (R) HIGH TEMP RTV SILICONE GASKET MAKER	PART NO 26BR	180480	2	3	OZF
PERMATEX (R) HIGH TEMP RTV SILICONE GASKET MAKER	PART NO 26BR	180480	3	3	OZN
PERMATEX (R) SILICONE FORM-A-GASKET (R) RTV BLUE	PART NO: 6BR, 6B, 6C	147838	24	3	OZF
PERMATEX FOOD GRADE SILICONE LUBRICANT	81246 SILICONE LUBRICANT	179438	23	18	OZF
PERMATEX FOOD GRADE SILICONE LUBRICANT	81246 SILICONE LUBRICANT	180460	4	18	OZF
PERMETHRIN	PERMETHRIN	181050	47	6	OZF
PEROXIDE	7298/HYDROGEN PEROXIDE 30%	182134	2	250	ML
PERVADE	PERVADE	182195	2	2.5	GL
PESTICIDE DEGRADATION SOLUTION	ISM-450	180983	1	8	ML
PESTICIDE MIX	EPZ00096	180076	1	1	ML
PESTICIDES SURROGATE STANDARD SPIKING SOLUTION	ISM-320	181167	1	4	ML
PETROLEUM ETHER	PETROLEUM ETHER	15377	18	20	LR
PETROLEUM ETHER	PX0425	15091	1	20	LR
PH BOOT SOLUTION	05566-51	180686	1	64	OZF
PH BOOT SOLUTION	PH BOOT SOLUTION	180688	1	1	GM
PH3641	PH3641	181719	1	1	GL
PHENOL, CRYSTALLIZED	A92-500	180817	1	500	GM
PHENOLPHTHALEIN INDICATOR SOLUTION	L2079	180497	5	100	ML
PHENYLARSIDE OXIDE SOLUTIONS	PHENYLARSINE OXIDE SOLUTIONS	148537	1	1	LR
PHENYLARSINE OXIDE SOLUTION, PH 6.5	SP68 1	180633	5	1	LR
PHENYLARSINE OXIDE STANDARD	PHENYLARSINE OXIDE STANDRD SOLN 0.0246N	15399	2	1	LR
PHOSPHORIC ACID	E-Z KLEAN	178820	3	1	QT
PHOSPHORIC ACID	E-Z KLEAN	180158	2	1	QT
PHOSPHORIC ACID	E-Z KLEAN	181047	16	1	QT
PHOTOMOUNT ADHESIVE	3M 6089/6090/6092/6094	181240	1	10	OZF
PICKLING COMPOUND	PICKLING COMPOUND	181581	2	4.5	LB
PIGMENT DISPERSION	1118447 CAL-TINT II 830-1824 RAW SIENNA	41335	4	16	OZF
PINK N MOLD	RB325 PORCELAIN, BOWL & SHOWER CLEANER	179653	45	32	OZF
PIPE CLEANER	J.A. SEXAUER MULE KICK WASTE PIPE CLEANER	180361	25	6	LB
PIPE CLEANER	J.A. SEXAUER MULE KICK WASTE PIPE CLEANER	181234	75	5	LB
PIPE CLEANER	J.A. SEXAUER MULE KICK WASTE PIPE CLEANER	181234	4	12	OZN
PIPE SEALANT STICK	5953/PIPE SEALANT STICK WITH TEFLON	181881	4	19	GM
PIPE THREAD SEALING COMPOUND	NO.5 RECTORSEAL	14604	6	8	OZN
PIPE THREAD SEALING COMPOUND	NO.5 RECTORSEAL	14604	23	16	OZN
PISTOL PETE PVC SOLVENT CEMENT	PISTOL PETE PVC SOLVENT CEMENT	148703	2	8	OZN
PITTBULL GRY PRIMER SPRAY	PITTBULL GRY PRIMER SPRAY	182007	32	11	OZF
PLASTI DIP	PLASTI DIP	179540	6	1	GL
PLASTIC ROOF CEMENT	R-36 SHIELD TITE PLASTIC CEMENT	15123	20	5	GL
PNEUMATIC LUBRICANT & CONDITIONER	652	179597	1	475	ML
POLYAMIDE	POTA-POX FC WHITE	181831	1	1	GL
POLYAMIDE	PRODUCT CODE: 44W007	178985	1	24	OZF
POLYAMIDE RESIN, AMINE & FILLER MIXTURE	CEILCOTE 663 CEILGARD, PART B	178726	1	2.85	LB
POLYMERIC MDI	INSTAPAK- COMPONENT "A"	15239	3	15	GL
POLYOL	INSTA PAK-40W COMPONENT "B"	15241	1	15	GL
POLYURETHANE ENAMEL TINTS	POLYURETHANE ENAMEL TINTS	182047	1	4	OZF
POLYURETHANE HARDENER	PC-09000	179433	1	1	GL
POLYURETHANE SEALANT	18814 DAP POLYURETHANE CONCRETE SEALANT	179984	10	10	OZF
PORTER GUARD DTM ACRYLIC SATIN ENAMEL	MC38	181475	7	1	GL
PORTER GUARD FAST DRY ALKYD ENAMEL	2750 PORTER GUARD	181705	4	1	GL
PORTER GUARD FAST DRY ALKYD SATIN ENAMEL	2708	181515	11	1	GL
PORTER GUARD FD ALKYD GLOSS ENAMEL	2728	181600	4	1	GL
PORTER GUARD FD ALKYD GLOSS ENAMEL	2749	181590	9	1	GL
PORTER GUARD FD ALKYD GLOSS ENAMEL	2754	181531	22	1	GL
PORTER GUARD HIGH HEAT--FLAT ALUMINUM	1503/ PORTER GUARD HIGH HEAT--FLAT ALUMINUM	181404	6	1	GL
PORTER GUARD WB SPRAY DRY FOG	9620	181126	31	1	GL
PORTER THANE 9200 CONVERTER PART A	PORTER THANE 9200 CONVERTER PART B	182080	3	1	GL
PORTERTUF 2000 BLACK "A"	PC2032A	181585	1	1	GL
PORTERTUF 2000, BLACK PART B	PC2046B	181586	1	1	GL

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
POTASSIUM CHLORIDE,ACS	POTASSIUM CHLORIDE	102892	1	500	GM
POTASSIUM HYDROXIDE IN ETHANOL VOLUMETRIC SOLUTION	5645, 5644	180916	2	2	LR
POTASSIUM HYDROXIDE SOLUTION	ST110 500, ST110500	180781	2	500	ML
POTASSIUM PERMANGANATE FREEFLO	23128/ #330 POTASSIUM PERMANGANATE FREEFLO	181432	10	55	LB
POTASSIUM PERMANGANATE FREEFLO	23128/ #330 POTASSIUM PERMANGANATE FREEFLO	181432	2	330	LB
POTASSIUM PERMANGANATE, TECHNICAL	CAIROX POTASSIUM PERMANGANATE	15003	1	55	LB
POTASSIUMPERMANGANATE FREEFLO	PRODUCT CODE: 07630	179004	4	55	LB
POTASSIUMPERMANGANATE FREEFLO	PRODUCT CODE: 07630	179004	1	100	LB
POTASSSIUM PERMANGANATE	POTASSSIUM PERMANGANATE	181810	2	500	GM
POWDER	BULLSEYE DOUBLE-BASE SMOKELESS POWDER	179644	2	1	LB
PPG PITBULL GRAY PRIMER	55-615	181802	31	11.75	OZN
PPG PITBULL GRAY PRIMER	55-615	181809	29	11.75	OZN
PRE-TINTED 4053 COOL BLUE	87999999 METALATEX	181017	1	5	GL
PRECOR IGR CONCENTRATE	PRECOR IGR CONCENTRATE	181758	13	1	PT
PREMIUM VACUUM PUMP OIL	DIRECTORR 8995P	179316	11	1	LR
PRESSURE SENSITIVE ADHESIVE	3M 72 PRESSURE SENSITIVE ADHESIVE	179071	1	17	OZF
PRESSURE SENSITIVE PAINT	ISSI FIB-BASED PRESSURE-SENSITIVE PAINT: FORMULATION 2	181565	3	1	LR
PRIMER	19-088, 19-089/SURFACE PRIMER	181979	1	1	GL
PRIMER	ARMOR SEAL 5020,PART #B58 VQ5020,PART A	178536	1	5	OZF
PRIMER	DP40, DP50 (051595S)	179291	5	1	GL
PRIMER	DP40, DP50(051595S)	178970	3	1	GL
PRIMER	LOCQUIC PRIMER 7649	181576	9	4.5	OZF
PRIMER	PRIMER N 7649 21347	180960	31	25	GM
PRIMER	SILICONE ELASTOMER PRIMER	179421	1	1	OZF
PRIMER	STAYS ON METAL PRIMER	181029	8	1	GL
PRIMER	TC OMNIPRIME	179275	5	1	GL
PRIMER	U-PRIME-WHITE #286	182081	4	1	GL
PRIMER GLOSS 4300 GRAY	PC4301A (4300A)	181270	1	1	GL
PRIMER T 7471 AEROSOL	22477	179978	4	4.5	OZN
PRISM (R) 426 BLACK TOUGHENED GEL	ITEN NO. 18398 CYANOACRYLATE	179352	1	20	GM
PRISM(R) 406 SURF-INSENSITIVE INST. ADH.	PRISM(R) 406 SURF-INSENSITIVE INST. ADH PRODUCT# 40604	148124	2	0.1	OZF
PRO MAR 400 SEMI-GLOSS	B34 W 402 MIDTONE BASE	14680	13	1	GL
PRO MAR 400 SEMI-GLOSS	B34 W 402 MIDTONE BASE	14680	10	1	PT
PRO-MASTER 2000 ALKYD S/G ENAMEL LIGHT BASE	149	181063	60	1	GL
PRO-MASTER 2000 ALKYD S/G ENAMEL LIGHT BASE	6749-2 BROWN TINT	181746	1	1	GL
PRO-MASTER 2000 ALKYD S/G ENAMEL LIGHT BASE	MC 38 WALNUT BROWN	181749	2	1	GL
PRO-MASTER 2000 ALKYD S/G ENAMEL LIGHT BASE	MC 38 WALNUT BROWN	181879	18	1	GL
PRO-MASTER 2000 ALKYD S/G ENAMEL LIGHT BASE	OIL BASE INTERIOR ENAMEL	181874	4	1	GL
PRO-MASTER 2000 INTERIOR OIL DEEP BASE	148	181842	2	1	GL
PRO-SEAL 890 B-2 PART A ACCELERATOR COMPONET	FM0644E	181983	1	1	PT
PRO-TREAT 151	PRO-TREAT 151	182112	6	12	OZN
PROBLOCK	B51 W 20	178834	6	1	GL
PROBLOCK	B51 W 20	181871	2	1	GL
PROCESS COLOR	SCOTCHLITE PROCESS COLOR 883I BLUE	180534	1	1	QT
PROMAR 200 EG-SHEL	PROMAR 200 B33 W 201	148758	1	1	GL
PROMAR 400 EG-SHEL	B20 W 401	178609	1	5	GL
PROMAR ALKYD SEMI-GLOSS ENAMEL-DEEPTONE BASE	PRO-MAR ALKYD SEMI-GLOSS ENAMEL, DEEPTONE BASE	14564	1	1	GL
PROMAR TRAFFIC MARKING PAINT - WHITE	PROMAR TRAFFIC MARKING PAINT	180121	4	5	GL
PROPANE CYLINDER	PROPANE CYLINDER	179358	30	16.4	OZN
PROPANE CYLINDER	PROPANE CYLINDER	179358	42	20	LB
PROPANE CYLINDER	PROPANE CYLINDER	179358	1	30	LB
PROPANE IN AIR	PROPANE IN AIR	181742	1	250	CF
PROPANE, OXYGEN, NITROGEN MIXTURE	10028034 CALIBRATION CHECK GAS, 0.6% PROPANE IN AIR	182100	2	10	OZF
PROPANE/AIR	PROPANE/AIR	181752	2	3.6	CF
PROPANE/DIMETHYLMETHANE PARAFFINIC HYDROCARBON	GS-10F-48303 LP-175-005G TURNER TORNADO	9094	16	14	OZF
PROPYLENE GLYCOL	09776/PROPYLENE GLYCOL	182116	5	55	GL
PROPYLENE GLYCOL	11024	181673	13	55	GL

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
PROPYLENE GLYCOL	DOWFROST HD HEAT TRANSFER FLUID	180753	1	55	GL
PROPYLENE GLYCOL	PGUSP	181210	1	55	GL
PROPYLENE GLYCOL	PROPYLENE GLYCOL	181232	15	55	GL
PROTECTIVE COATING	GAGEKOTE 8	182341	1	8	OZF
PST PIPE SEALANT WITH TEFLON 567 THREAD	56765	181806	29	50	ML
PST(R) PIPE SEALANT W/TEFLON	PART NO:59231/59214/59217	148316	12	8.45	OZF
PSUDOMONAS AERUGINOSA (27853)	4337044	180884	1	25	GM
PUMP FLUID	DOW CORNING 705(R) DIFFUSION PUMP FLUID	182246	2	500	CC
PURE WHITE	B33W201 (BASE X)	179328	20	1	GL
PURPLE	F-900 TORQUE SEAL	181437	12	4	OZF
PVC CEMENT	PVC CEMENT	181782	1	16	OZF
PVC PRIMER	PVC PRIMER	181215	1	8	OZN
PVC PRIMER	PVC PRIMER	181783	1	16	OZF
PVC/CPVC PRIMER	P-70 PRIMER FOR PVC AND CPVC PLASTIC PIPE	178884	1	1	PT
PYRIDINE	CATALOG NO. 368-1, PYRIDINE	180390	1	1	LR
QUICK DRY ENAMEL, ALUMINUM	F77S12	14956	1	5	GL
QUICK SETTING ADHESIVE	ZAP-A-GAP CA+	182269	4	1	OZN
QUICK STARTING FLUID	CARQUEST QUICKSTARTING FLUID	181771	2	11	OZF
QUICKTITE GEL BLUE WINGS 4GR	01-30379	181876	23	4	GM
R7 K 54 REDUCER NO. 54	R7 K 54 REDUCER NO. 54	14633	6	1	GL
RAID WASP & HORNET KILLER X	RAID WASP & HORNET KILLER X	147801	9	14	OZF
RAW UMBER BLEND-A-COLOR	BLEND-A-COLOR A60N1	15355	17	1	QT
RC (TM) 609 RETAINING COMPOUND GENERAL PURPOSE	ITEM NO. 60921	180961	5	10	ML
RE-TIN SOLDERING TIPS	TT-95, TT-95-S, TT-95-SP / PLATO-TIP TINNER	182338	1	0.07	OZN
REAGENT	FERROVER IRON REAGENT	180038	8	0.1	MG
RECONSTITUTED BREATHING AIR	RECONSTITUTED BREATHING AIR	15166	14	235	CF
RED	SCOTCHLITE PROCESS COLOR 882I RED	180535	1	1	QT
RED ACRYLIC ENAMEL	AR-06253	179434	1	1	GL
RED CRO4 PRIMER	RED CRO4 FREE PRIMER	178978	1	96	OZF
RED URETHANE SEAL COAT AEROSOL	RED URETHANE SEAL COAT AEROSOL	14674	1	11	OZF
RED URETHANE SEAL COAT AEROSOL	RED URETHANE SEAL COAT AEROSOL	14674	138	16	OZF
RED URETHANE SEAL COAT AEROSOL	RED URETHANE SEAL COAT AEROSOL	179386	1	11	OZF
RED URETHANE SEAL COAT AEROSOL	RED URETHANE SEAL COAT AEROSOL	179386	55	16	OZF
REDUCER NO. 58	R7 K 58	178883	220	1	GL
REFRIGERANT	GENETRON 22	181001	18	30	LB
REFRIGERANT	R134A	178563	3	30	LB
REFRIGERANT 500	MSDS #2405	179378	12	125	LB
REGALFATE	REGALFATE	182189	3	30	LB
REGULAR EPOXY ADHESIVE	SCOTCH-WELD 2214	181203	9	6	OZF
RELEASE AGENT	1667 / LIQUID RELEASE AGENT	182137	6	1	PT
REPEL PERMANONE	PRODUCT CODE: 326	178959	1	6	OZF
REPEL PERMANONE	PRODUCT CODE: 326	179031	1	6	OZF
RESBOND 105 RF	RESBOND 105 RF	181714	1	1	PT
RESBOND 907 REFRACTORY ADHESIVE	907/ RESBOND	181951	9	3	OZN
RESIN	0321 / FLEXANE 94 LIQUID RESIN	182138	5	10	LB
RESIN	0321 / FLEXANE 94 LIQUID RESIN	182138	2	12	OZN
RESIN	AA9277000 / EA 9394 PART A	182273	3	1	QT
RESIN	ARALDITE 2011/A	179542	17	100	ML
RESIN	FIBERGLASS RESIN	182126	3	8	OZN
RESIN	HIT HY 150	182152	1	11.1	OZN
RESIN	HIT HY 150 METHACRYLATE RESIN	182259	2	11.1	OZN
RESIN	ITW RAMSET/RED HEAD EPCON SYSTEM GRANITE 5	179044	12	1	LB
RESIN	JB WELD E POXY STEEL RESIN (PART B)	181149	1	1	OZF
RESIN	MARINE TEX LIQUID RESIN (PART A)	181158	6	1	GL
RESIN (PART A)	DURALCO 4525	181616	2	16	OZF
RESIN (PART A)	DURALCO 4703	181614	3	16	OZF
RESIN - PART B	TRA-BOND 2151 RESIN PART B	181650	2	0.75	OZF
RESIN EPOXY KIT	M-BOND AE RESIN	181143	1	6	MG
RESTROOM CLEANER	KV0001SQ/KAIBLOOEY	182368	4	1	GL
RETAINING COMPOUND	LOCTITE(R) 609 RETAINING COMPOUND PRESS FIT	182265	4	50	ML
RETAINING COMPOUND 620 HIGH TEMPERATURE	62040	179589	3	501	ML
RETARDER THINNER, 1182	RETARDER THINNER, 1182	72128	1	1	QT
RETREAT DEFOAMING AGENT	RETREAT DEFOAMING AGENT	182211	1	1	QT
REXTHANE HEAVY DUTY POLYURETHANE VARNISH	B44V20	179452	8	1	GL
RITE-LOK	RITE-LOK EC100-28	179354	7	1	OZF
ROAD MARKING PAINT	1419	181198	4	1	GL

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
RODENTICIDE	WEATHERBLOK XT	181830	3	11	LB
ROOF CEMENT	R-18-C	147733	2	5	GL
ROOF PATCH	HENRY 208	181720	12	11	OZF
ROYAL BLUE 980603, V2182	RUST-OLEUM, ROYAL BLUE PRIMER 5H903, 5H904, 5H906, 5U705	182179	4	15	OZF
RP 1710 HARDENER	RP 1710 HARDENER	135517	10	0.34	LB
RP 1710 RESIN	RP 1710 RESIN	135516	5	2	LB
RTV SILICONE	51382	179401	84	11	OZF
RTV SILICONE	59675	180581	1	10.3	OZF
RTV SILICONE	59675	180692	195	10.3	OZF
RTV SILICONE SEALANT	RTV106	181305	1	10	OZN
RTV SILICONE SEALANT	RTV106	181305	71	10.1	OZN
RUBBER COVE BASE ADHESIVE	FLEXCO 106R RUBBER COVE BASE ADHESIVE	15320	3	1	GL
RUBIDIUM NITRATE	10852	179852	1	20	GM
RUST NOT W/R METAL PRIMER WHT	3090 GIL-KOTE	148733	1	1	GL
RUST PROOF PAINT	301 SAFETY RED	181458	21	12	OZF
RUST PROOF PAINT	303 SAFETY BLUE	181459	11	12	OZF
RUST PROOF PAINT	305 SAFETY ORANGE	181457	4	12	OZF
RUST PROOF SPRAY PAINT	7719T11 SERIES	180780	5	12	OZF
RUST REMOVER	INTERNALTIONAL COMPOUND #212-LF	182133	1	55	GL
RUST REMOVER	OSPHO RUST REMOVER (PHOSPHORIC ACID)	181231	1	1	GL
RUST ROUGH RUST PREVENTIN ENAMEL (AEROSOL), GLOSS BLACK	RTA9202	181967	40	10	OZF
RUST TOUGH AEROSOL PAINT	SAFETY RED (R00539)	181280	4	20	OZF
RUST TOUGH AEROSOL PAINTS	LT. MACHINE GRAY (R00839)	181281	2	15	OZN
RUST TOUGH AEROSOL PAINTS	LT. MACHINE GRAY (R00839)	181281	4	20	OZN
RUST TOUGH RUST PREVENTIN ENAMEL (AEROSOL), RADIANT RED	RTA9210	181969	11	10	OZF
RUST TOUGH RUST PREVENTIVE ENAMEL (AEROSOL), GLOSS WHITE	RTA9200	181968	54	10	OZF
SAFETY BLUE	7891T32,321 (ID NUMBER V2124 838)	181259	6	15	OZF
SAFETY RED ALKYD GLOSS ENAMEL	PORTER GUARD F.D. 2772	181186	2	1	GL
SAFETY SOLVENTS	SAFETY SOLVENTS 105RP AND 105RS	181711	1	1	QT
SCALE CONDITIONING COMPOUND	TURCO 4338	178806	2	125	LB
SCALE REMOVING COMPOUND	LIME-A-WAY	179840	17	16	OZF
SCOTCH-GRIP HIGH PERFORMANCE CONTACT ADHESIVE	1357	181805	1	5	OZF
SCOTCHRAP BRAND PIPE PRIMER	UPC # 00-54007-34548-0	14673	1	1	GL
SCREEN INK	59-112 WHITE	180386	4	1	QT
SCREEN INK	59-152 PEACOCK BLUE	180385	3	1	QT
SCREEN INK	59000 ENAMEL PLUS GLOSS SCREEN INK	148432	5	0.25	QT
SCREEN INK	59000 ENAMEL PLUS GLOSS SCREEN INK	148432	2	1	QT
SCREEN INK	59000/ENAMEL PLUS SCREEN INK	182113	1	1	QT
SCREEN INK 59156	59156 ENAMEL PLUS GLOSS SCREEN INK	154980	3	1	QT
SCREEN INK 59158	59158 ENAMEL PLUS GLOSS SCREEN INK	154995	1	1	QT
SEAL-IT DRY	SEAL-IT-DRY	179568	2	18	LB
SEALANT	30516	180689	18	1	PT
SEALANT	30516	180689	5	16	OZF
SEALANT	4036 LIQUID-VAC SEALANT	179854	3	0.25	PT
SEALANT	9240 / SYNKO-FLEX PREFORMED PLASTIC WATERSTOP	182135	1	1	GL
SEALANT	TORQUE SEAL (LEMON)	180970	12	4	OZF
SEALANT	TORQUE SEAL (RED)	180971	11	4	OZF
SEALING CEMENT POWDER	OB70C	181924	6	8	OZF
SEALING COMPOUND	222	132426	80	10	ML
SEALING COMPOUND	732 MULTI-PURPOSE SEALANT CLEAR	179501	1	10.3	OZF
SEALING COMPOUND	CHICO, A SEALING COMPOUND	148709	65	1	LB
SEALING COMPOUND	GASOILA VARNISH TYPE SEALANT	102490	2	0.5	PT
SEALING COMPOUND	GASOILA VARNISH TYPE SEALANT	102490	2	1	PT
SEALING COMPOUND	GASOILA VARNISH TYPE SEALANT	102490	27	8	OZF
SEALING COMPOUND	LEAK LOCK (R)	148272	11	1.3	OZN
SEALING COMPOUND	LEAK LOCK (R)	148272	3	13.6	OZN
SEALING COMPOUND	PLS-2 PLASTIC LEAD SEAL PB-04	89379	52	1	LB
SEALING COMPOUND	PLS2 PLASTIC LEAD SEAL	89378	59	0.25	PT
SEALTIGHT GARDOX COMPONENT A	SEALTIGHT GARDOX COMPONENT A	181696	3	0.5	GL
SEALTIGHT GARDOX COMPONENT B	SEALTIGHT GARDOX COMPONENT B	181697	4	0.5	GL
SEMI-TRANSPARENT WOOD PRESERVATIVE STAIN	A14T5 - TINTED SALEM RED	179252	8	1	GL
SEMI-VOLATILES BC/MS TUNING STANDARD	GCM-150	181166	1	150	KG
SETFAST TRAFFIC MARKING PAINT	TM2135 BLACK (640114682)	180790	2	5	GL

Table G-1: (continued)						
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
SETFAST TRAFFIC MARKING PAINT	TM226 AIRFIELD WHITE	179255	1	5	GL
SETFAST TRAFFIC MARKING PAINT (WATERBORNE)	TM-225 AIRFIELD YELLOW	148763	1	5	GL
SHARPENING COMPOUND	39523/SHARPENING COMPOUND	181936	2	1	LB
SHER-WOOD KEM-AQUA LACQUER, MEDIUM RUBBERT EFFECT	T75F527	179248	1	5	GL
SHER-WOOD NATURAL FILLER	D70T1	180082	3	1	GL
SIKAFLEX 1A	SIKAFLEX 1A	179716	2	10.3	OZF
SIKAFLEX 2C, NS-PART A	SIKAFLEX 2C, NS-PART A	181723	15	1	GL
SILICA GEL	BLUE INDICATING GEL	181872	2	8	LB
SILICONE	30684/LOCTITE INSTANT GASKET	182149	34	4	OZN
SILICONE	81878/ 101BR ULTRA COPPER RTV SILICONE GASKET MAKER	182059	35	3	OZN
SILICONE	PST-511 SILICONE COMPOUND	182079	10	5.3	OZN
SILICONE COMPOUND	G623	127146	1	12	OZN
SILICONE ELASTOMER	58149	179422	2	10	OZN
SILICONE MODIFIED ALKYD RESIN	5H939, 5H941, 5H943 (4233, 4279, 4286)	179900	1	1	GL
SILICONE RUBBER	DOW CORNING(R) 3120 RTV SILICONE RUBBER	182227	1	9	LB
SILICONE RUBBER	RTV60	180701	5	1	LB
SILICONE RUBBER	RTV60	180701	1	3	OZN
SILICONE SEALANT	100% RTV SILICON	14988	2	10.3	OZF
SILICONE SEALANT	100% RTV SILICON	148136	378	3	OZN
SILICONE SEALANT	100% RTV SILICONE	178629	70	3	OZN
SILICONE SEALANT	100% SILICONE SEALANT ARCHITECTURAL GRADE	181949	18	10.1	OZN
SILICONE SEALANT	DOW CORNING (R) 732 MULTI-PURPOSE SEALANT, CLEAR	181630	21	10.1	OZN
SILICONE SEALANT	GE5020	147654	88	10.1	OZF
SILICONE SEALANT	GE5020	147654	54	10.5	OZF
SILICONE SEALANT	GE5020	148750	11	10.1	OZF
SILICONE SEALANT	GE5020	148750	6	10.5	OZF
SILICONE SEALANT	PSI-601 SILICONE SEALANT	148271	1	3	OZN
SILICONE SEALANT	PSI-601 SILICONE SEALANT	148274	2	0.06	KG
SILICONE SEALANT	SILASTIC 732 (R) RTV ADHESIVE SEALANT, CLEAR	14846	4	3	OZN
SILICONE SEALANT	SILASTIC 732 (R) RTV ADHESIVE SEALANT, CLEAR	148759	69	10.3	OZN
SILICONE SEALANT (HIGH TEMP RED)	169201/169219/169227/POLYBAC #500	181991	23	4.7	OZN
SILIKROIL	SILIKROIL	181966	57	16.5	OZN
SILOO AIR BRAKE CONDITIONER	59A, 59B, 59D	15131	2	32	OZF
SILVER FILLED ACRYLIC PAINT	DYNALOY 340	180754	3	500	GM
SILVER THERMAL COMPOUND	OCZU5STP/ULTRA 5+HIGH-DENSITY POLYSYNTHETIC SILVER COMPOUND	182365	2	3	GM
SLIC-TITE PASTE WITH TEFLON	SLIC-TITE PASTE WITH TEFLON	180814	11	1	LB
SO-SURE BLUE 15045	BLUE 15045	6615	2	16	OZF
SO-SURE FLAT BLACK 37038	PART # 012C892	178545	1	1	PT
SODA ASH	SODIUM CARBONATE	148120	1	1000	LB
SODA ASH	SODIUM CARBONATE	148120	1	3000	LB
SODIUM BORATE SOLUTION	LC11710, LC22960, LC12450 (BUFFER PH 9.18)	179965	1	500	ML
SODIUM BORATE SOLUTION, BORAX 1-4%, BUFFER PH 9.18	LC12450-1	180986	1	500	ML
SODIUM HEXAMETAPHOSPHATE	MSDS # M7612	15306	1	23550	LB
SODIUM HEXAMETAPHOSPHATE	MSDS # M7612	15306	1	30000	LB
SODIUM HYDROXIDE	SODIUM HYDROXIDE	179550	6	20	LR
SODIUM HYDROXIDE SX0607H	SODIUM HYDROXIDE SX0607H	182085	1	1	LR
SODIUM HYDROXIDE SOLUTIONS	MK770504	181652	1	500	ML
SODIUM HYPOCYHLOROITE SOLUTION	SODIUM HYPOCHLORITE SOLUTION	178948	1	55	GL
SODIUM HYPOPHOSPHITE, TECHNICAL	SODIUM HYPOPHOSPHITE	88528	1	0.5	LB
SODIUM SULFATE	SODIUM SULFATE	180556	1	12	KG
SODIUM SULFATE ANHYDROUS	S415 500	180453	2	500	ML
SODIUM SULFITE ANHYDROUS	MSDS NO. 001350	148826	1	1240	LB
SODIUM SULFITE ANHYDROUS	MSDS NO. 001350	148826	1	1400	LB
SODIUM SULFITE ANHYDROUS	MSDS NO. 001350	148826	1	2400	LB
SODIUM SULFITE ANHYDROUS	MSDS NO. 001350	148826	1	3000	LB
SODIUM SULFITE ANHYDROUS	MSDS NO. 001350	148826	1	4000	LB
SODIUM SULFITE, SYNETHETIC ANHYDROUS	84-10	180530	1	2805	LB
SOLDER	ALL-STATE SILVER SOLDER	180351	4	1	LB
SOLDER, PASTE	NOKORODE SOLDERING PASTE	123470	1	0.57	KG
SOLDERING PASTE	RUBYFLUID SOLDERING PASTE	14751	2	0.185	KG
SOLID COLOR ALKYD STAIN	A14 R 533 CAPE COD RED	178840	6	1	GL
SOLIDIFIER	1117-1282 BELZONA 2221 (PART B)	181329	3	235	GM
SOLIDIFIER	BELZONA 1111 SOLIDIFIER	180409	9	1	KG

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
SOLVENT	HOLSTER/INSTAPACKER SOLVENT	148210	1	1	GL
SOLVENT	RV-372 / TERPINEOL	182255	4	1	PT
SOLVENT BASED ADHESIVE	066	181986	4	5	GL
SOLVENT BASED ADHESIVE	547	181985	1	5	GL
SOLVENT BASED ENAMEL	SLIP NO MORE, NSC, COLOR TRED	14592	2	1	GL
SOLVENT BLEND	PYROIL STARTING FLUID SFP 7.5	179869	4	7.5	OZF
SOLVENT BLEND	PYROIL STARTING FLUID SFP 7.5	179869	66	11	OZF
SOLVENT BLEND	PYROIL STARTING FLUID SFP 7.5	181859	5	11	OZF
SOLVENT CLEANER	22355 / ODC-FREE CLEANER & DEGREASER	182324	3	15	OZN
SOLVENT CLEANER	79040 / CHISEL(R) GASKET REMOVER	182287	30	18	OZF
SOLVENT CLEANER	CYTRA KLEAN	14837	10	55	GL
SOLVENT MIXTURE CON	10-1902 DE-OX-ID	14598	1	2	OZF
SOLVENT, MINERAL SPIRITS	CKPT94402/KS PAINT THINNER COND 5 GL	182362	25	5	GL
SONOCRETE KURE-N-SEAL 30	SONOCRETE KURE-N-SEAL 30	181727	1	55	GL
SONOLASTIC SL-1 (ALL COLORS)	35-913	148154	72	30	OZN
SOUTHLAND FLOORING ADHESIVE	430	181564	6	1	GL
SOUTHLAND FLOORING ADHESIVE	SOUTHLAND 300	181229	3	1	GL
SOUTHLAND FLOORING ADHESIVE	SOUTHLAND 400	181654	1	1	GL
SP CONCENTRATE	SP CONCENTRATE	14857	11	55	GL
SPECIAL CONCENTRATE ALL PURPOSE	867855	180388	12	55	GL
SPECIAL MIXTURE	SP-7271-DHPZ	179527	1	100	ML
SPECIAL WIRE ROPE LUBRICANT	MSDS # SI-353	178720	1	120	LB
SPOOLED, COILED & CUT LENGHT SOLID STAINLESS STEEL WIRE	ER308L	180709	1	1	LB
SPOTCHECK PENETRANT SKL-SP	SPOTCHECK PENETRANT SKL-SP	181765	1	1	GL
SPRAY B-I-N	01008	181659	23	13	OZF
SPRAY BIN	WZ1008	179583	36	12	OZF
SPRAY BUFFER	OVER DRIVE SPRAY BUFF	180024	7	12	OZN
SPRAY PAINT	V2155 838 / SAFETY ORANGE 9905581	182233	6	12	OZF
SPRAY PAINT	0000160604 / TREE AND INDUSTRIAL MARKER FLAT WHITE	182224	19	12.6	OZF
SPRAY PAINT	1656-838/ORANGE FLUORESCENT SPRAY PAINT	181953	3	17	OZN
SPRAY PAINT	2188 838 / SMOKE GRAY 0007142	182235	6	12	OZF
SPRAY PAINT	305 ORANGE	181154	9	12	OZF
SPRAY PAINT	3151 / KRYLON MAGNETIC PAINT	182144	2	13	OZN
SPRAY PAINT	FLUORESCENT ORANGE	181504	2	12	OZF
SPRAY PAINT	FLUORESCENT ORANGE	181504	9	17	OZF
SPRAY PAINT	R00439 SAFETY YELLOW	181278	9	20	OZF
SPRAY PAINT	R00789 / RUST TOUGH RUST PREVENTIVE ENAMEL, FLAT BLACK	182239	16	12	OZN
SPRAY PAINT	RUST-OLEUM HIGH PERFORMANCE INDUSTRIAL ENAMEL AEROSOL-TOPCOA	182238	6	12	OZF
SPRAY PAINT	V2134 838 / BRIGHT GREEN 9806042	182236	6	12	OZF
SPRAY PAINT	V2143 838 / SAFETY YELLOW 9904442	182232	6	12	OZF
SPRAY PAINT	V2163 838 / SAFETY RED 9904440	182231	6	12	OZF
SPRAY PAINT	V2171 838 / TAN 9806057	182234	6	12	OZF
SPRAY PAINT	V2175 838 / CHESTNUT BROWN 9806059	182230	6	12	OZF
SPRAY PAINT	V2177 838 / SEMI-GLOSS BLACK 9904444	182237	6	12	OZF
SPRAY PAINT, GLOSS ORANGE	140-2452 / SUPERACRYLIC CONTROLS RUST SPRAY ENAMEL	182314	4	16	OZN
SPRAYON 711 THE PROTECTOR LUBRICANT	SPRAYON 711 THE PROTECTOR LUBRICANT	181766	41	11	OZF
SPRAYON BLUE LAYOUT FLUID	560208	181519	10	8	OZF
SPRAYON CLEAR INSULATING VARNISH	1D268	181796	9	12	OZF
SPRAYTEC ANTI-STATIC SPRAY (12-3/4 OZ.)	32N1079-ANTI-STATIC SPRAY	14602	17	12.75	OZN
SS4 COVE BASE ADHESIVE	SS4C	179520	4	1	GL
STA-KIL PRIMER WHITE	164	181571	18	1	GL
STABIL FUEL STABILIZER	1130	181524	3	30	GL
STAIN, PLANTATION WALNUT	738 / WOODSHEEN RUBBING OIL STAIN AND FINISH, PLANTATION WAL	182143	4	12	OZN
STAINLESS STEEL FLUX	STAINLESS STEEL FLUX	14590	2	1	PT
STAINLESS STEEL FLUX	STAINLESS STEEL FLUX	14590	1	8	OZF
STANDARD	CONOSTAN S-21 BLENDED STANDARDS	180402	2	0.06	GL
STANDARD	N2B VISCOSITY STANDARD	181516	1	1	PT
STANDARD	SP-7271-MHPZ	179862	1	500	ML
STANDARD MIX	48902 SV INTERNAL STANDARD MIX	181162	3	1	ML
STARCH ACID IDICATOR	552	148461	5	13	OZF
STARTING FLUID	IG-LO STARTING FLUID 1015	14981	60	11	OZF
STATIC DISSIPATIVE FLOOR CLEANER	GROUND OUT	181573	8	1	GL
STATIC NULL	STATIC NULL	148674	12	15	OZF
STAY-CLEAN ALUMINUM FLUX	STAY-CLEAN SOLDERING FLUXES	148152	1	16	OZF

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
STEAMATE FM761	STEAMATE FM761	181397	1	6632	LB
STONE GRAY	1605	181663	3	12	OZF
STRAIN GAGE COATING	GAGEKOTE #8 PROTECTIVE COATING	181541	1	1	OZF
STRIP-X	STRIP-X 10-2602, 10-2616	14660	1	16	OZN
STRIP-X	STRIP-X 10-2602, 10-2616	179547	1	2	OZN
STRIPPER	BRAVO EXTRA HEAVY DUTY STRIPPER	179954	140	1	GL
STRIPPER	BRAVO EXTRA HEAVY DUTY STRIPPER	179954	12	5	GL
STRONTIUM	100053-1/ STRONTIUM	181415	1	100	ML
STRUCTURAL ADHESIVE	32430 / SPEEDBONDER	181843	3	50	ML
STRUCTURAL ADHESIVE 5406R	VERSILOK HI 406	148288	34	43	ML
SULFAMIC ACID	A295-100	181816	1	100	GM
SULFANILAMIDE	04525-100	180391	1	100	GM
SULFUR HEXAFLUORIDE	SULFUR HEXAFLUORIDE	180327	1	115	LB
SULFURIC ACID	SULFURIC ACID	148356	6	1	LR
SULFURIC ACID	SULFURIC ACID	179850	1	5	GL
SULFURIC ACID	SX1244	181242	6	2.5	LR
SULFURIC ACID (N/50)	555	148462	4	1	QT
SULFURIC ACID 0.02N	SA226 1, SA226 20, SA226 4, SA2261, SA22620, SA2264	180771	6	1	LR
SULFURIC ACID SOLUTION 19.2N	203849	181528	19	500	ML
SULFURIC ACID,ACS	SULFURIC ACID,600	147936	1	5	GL
SUMP DEODORIZING TABLETS	3AU34-TABLETS ODOR CONTROL	182336	1	1	PT
SUPER GLUE	PERMABOND (R) 910	14939	67	1	OZN
SUPER HEAVY DUTY RADIATOR CLEANER	SUPER HEAVY DUTY RADIATOR CLEANER	182041	7	32	OZN
SUPER SOCKIT	HTH SUPER SOCKIT	180544	2	12	LB
SUPER SOCKIT	HTH SUPER SOCKIT	181760	164	1	LB
SUPER SOCKIT	HTH SUPER SOCKIT	181760	4	24	LB
SURFACTANT	SURF-AC 910	182210	5	1	GL
SURROGATE STANDARD MIX	STM-260N	180984	3	4	ML
SWIMMING POOL MARINE BLUE	DAMP-TEX 2	179492	6	1	GL
TAP MAGIC CUTTING FLUID	TAP MAGIC CUTTING FLUID	148547	1	1	PT
TAPPING FLUID	CRYOTOOL TAPPING FLUID	182109	12	1	PT
TAR AND BUG REMOVER	5015 TRAK AUTO BUG AND TAR REMOVER	181494	10	16	OZF
TC 6000 HI-TEMP PRIMER	TC 6000 HI-TEMP PRIMER	148187	1	2.5	GL
TEF-TAC PLUS	TEF-TAC PLUS	182185	6	11	OZF
TEKSOL EP	TEKSOL EP	148180	1	0.4	GL
TEKSOL EP	TEKSOL EP	148730	1	5	GL
TEKSOL EP	TEKSOL EP	148730	1	55	GL
TEMPERATURE INDICATING LACQUER	LAQ-0700	181095	1	2	OZF
TERMITICIDE CONCENTRATE	DOWELANCO EQUITY TERMITICIDE	179828	2	2	GL
TERPHENYL MIX LAB STANDARD	TERPHENYL MIX LAB STANDARD	181916	2	5	ML
TETRACHLOROETHYLENE	TETRACHOROETHYLENE	180795	7	4	LR
TETRAFLUOROBORATE	RHODAMINE 590	179750	4	10	GM
THERMAL EPOXY, HARDENER	3977-01	178566	1	0.04	KG
THERMAL SPRAY POWDER	METACERAM 21071	179659	12	3.3	LB
THERMAL SPRAY POWDER	XUPER ULTRABOND 50000	179788	5	1	KG
THINNER	9958/AEROGLAZE	181952	2	1	GL
THINNER	E-Z LACQUER THINNER	181185	10	1	GL
THINNER	PC5100 (T-1 EPOXY THINNER)	181275	1	1	GL
THINNER DOPE & LACQUER	A-A-857, THINNER,PAINT PRODUCT	12377	5	1	GL
THINNER,PAINT PRODUCT	A-A-857, THINNER,PAINT PRODUCT	94035	3	1	GL
THOROBOND	THOROBOND	180292	1	1	GL
THREAD SEALANT	561 PIPE SEALANT STICK	181854	7	0.67	OZN
THREAD SEALANT HIGH TEMPERATURE	56765 PST PIPE SEALANT W/TEFLON 567 THREAT SEALANT HIGH TEMP	181695	2	2	OZF
THREAD SEALANT HIGH TEMPERATURE	56765 PST PIPE SEALANT W/TEFLON 567 THREAT SEALANT HIGH TEMP	181695	6	250	ML
THREAD SEALANT PASTE	GRAFOIL (GTS) THREAD SEALANT PASTE	181917	5	4	OZN
THREADLOCKER	26673/266 THREADLOCKER, HIGH TEMP/HIGH STRENGTH	181901	1	50	ML
THREADLOCKER	27240/272 THREADLOCKER, HIGH STRENGTH	181900	7	50	ML
THREADLOCKER	27741/277 THREADLOCKER HIGH STRENGTH	181893	5	10	ML
THREADLOCKER	27741/277 THREADLOCKER HIGH STRENGTH	181893	1	250	ML
THREADLOCKER HIGH TEMP/MED STRENGTH	LOCTITE (R) 246	181546	1	10	ML
THREADLOCKER HIGH TEMP/MED STRENGTH	LOCTITE (R) 246	181546	9	50	ML
THREADSEALANT	56747 / 567(TM) THREAD SEALANT PST PIPE SEALANT WITH PTFE	182284	30	50	ML
THRIFT KOTE	THRIFT KOTE	181729	1	55	GL
TICK REPELLANT	32600.1 / REPEL PERMANONE	182309	48	6	OZF

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
TILE CLAD II ENAMEL	B62N71 BROWN	148562	2	1	GL
TILE CLAD II ENAMEL	B62W103 DEEPTONE BASE	148632	1	1	GL
TILE-CLAD	B62WZ102 MIDTONE BASE	179499	4	1	GL
TILE-CLAD EPOXY COATINGS HARDENER	B60V70	148564	13	1	GL
TILE-CLAD HIGH SOLIDS EMANEL HARDENER	B60V70	148197	71	1	GL
TILE-CLAD HIGH SOLIDS EMANEL HARDENER	B60V70	148566	15	1	GL
TILE-CLAD HIGH SOLIDS ENAMEL (PART A), PURE WHITE.	B62WZ101	148198	29	1	GL
TILE-CLAD II ENAMEL	B60V70	14782	2	1	GL
TIP DIP	CANTESCO NOZZLE TIP DIP	181691	2	16	OZF
TOLUENE	TX0737	180834	9	4	LR
TONER	SCOTCHLITE 880I TONER	180536	1	1	QT
TOP COAT	FIB-BASED PSP TOP COAT	180615	4	800	ML
TOPCOAT/EPOXY MASTIC	9115402/HIGH PERFORMANCE EPOXY MASTIC ALUMINUM	182363	1	1	GL
TORCH KIT	MAPP GAS	181710	4	1	CF
TORCH OUTFIT	78645A38	181875	1	14.1	OZN
TOTAL CHLORINE BUFFER SOLUTION	22635	180812	2	8	OZF
TOTAL CHLORINE INDICATOR	22634	180811	2	8	OZF
TOUCH N FOAM MINIMAL EXPANSION	TOUCH N FOAM EXP HOLE FILLER REDDY INSULATION	178751	2	12	OZF
TOUCHDOWN HERBICIDE	TOUCHDOWN HERBICIDE	148596	1	2.5	GL
TOUGH COAT	S61310 OSHA YELLOW	179919	8	12	OZF
TOUGH COAT	S61770 OSHA BLACK	179920	5	12	OZF
TOUGH COAT LATEX	S61800 OSHA WHITE	179918	1	12	OZF
TOXAPHENE LAB STANDARD	32005 / TOXAPHENE MIX	182240	1	2500	ML
TRACE METALS	SP-7271-LHPZ	179819	1	500	ML
TRAFFIC MARKING PAINT	A29Y2 PROMAR YELLOW	180937	1	5	GL
TRAFFIC MARKING PAINT	B29W1 PROMAR WHITE	148449	2	1	GL
TRANSPARENT LAYOUT FLUID	TOLE STEEL BLUE 80300	179985	1	4	OZF
TRANSPARENT LAYOUT FLUID	TOLE STEEL BLUE 80300	181207	26	4	OZF
TRANSPARENT LAYOUT FLUID	TOLE STEEL BLUE DX-100	127414	4	4	OZF
TRANSPARENT LAYOUT FLUID	TOLE STEEL BLUE DX-100	127414	5	8	OZF
TRI EPOXY FLOOR SEALER CLEAR (PART A)	MFG CODE# 98A	178752	2	1	GL
TRI EPOXY FLOOR SEALER CLEAR (PART B)	MFG CODE# 98B	178753	2	1	GL
TRI-BOMB	TRI-BOMB (INSECT FOGGER AEROSOL)	181755	21	12	OZF
TRI-FLO INDUSTRIAL LUBRICANT WITH TEFLON (AERSOL)	20025, 20027	181518	39	12	OZF
TRICHLOROETHYLENE	25642-0	180587	1	1	LR
TRICHLOROETHYLENE, 99.5+%, SPECTROPHOTO METRIC GRADE	256420	181485	1	103	LR
TRIMETHYLALUMINUM	TRIMETHYLALUMINUM	182087	2	5	GL
TURCO 4368	TURCO 4368	15024	3	55	GL
TWIST N' FILL CLEANER	3M BRAND QUAT DISINFECTANAT CLEANER CONCENTRATE TWIST'N FILL	181683	6	2	LR
TWIST N' FILL NO. 3 CLEANER	3M BRAND NEUTRAL CLEANER TWIST'N FILL NO. 3	181684	6	2	LR
TWIST N' FILL PRODUCT NO. 1 GLASS CLEANER	3M BRAND GLASS CLEANER CONCENTRATE TWIST N' FILL NO.1	181685	6	2	LR
TYPE 1	SHERLOCK LEAK DETECTOR	14795	17	12	OZN
ULTRA FLAT BLACK	1602 ULTRA FLAT BLACK	178873	2	12	OZF
ULTRA FLAT BLACK	1602 ULTRA FLAT BLACK	180878	14	12	OZF
UNDERCOATER	Y24W538 UNDERCOATER	147666	1	1	GL
UNIONMELT 429	SUBMERGED ARC WELDING FLUXES	181730	26	55	LB
UNIVERSAL CEMENT	UNIVERSAL CEMENT, RUBBER ADHESIVE	178838	3	8	OZF
UNIVERSAL CLEANER/DEGREASER	1677 AEROSOL	14562	146	22	OZF
UNIVERSAL PRECISION DUSTER	U51501-DYMEL 152A	180088	2	10	OZN
UNLEADED GASOLINE COMPOSITE STANDARD	UNLEADED GASOLINE COMPOSITE STANDARD	181915	1	5	ML
UNTINTED	2744 GLOSS	181206	1	1	GL
UPHOLSTERY CLEANER	T-246(C) / TURTLE WAX POWER OUT VINYL-FABRIC CLEANER	182315	1	22	OZN
UPSIDE DOWN MARKING PAINTS	03700 ALERT ORANGE	178607	67	17	OZF
UPSIDE DOWN MARKING PAINTS	03700 ALERT ORANGE	178607	43	20	OZF
V.M.&P. NAPHTHA	REDUCER	180122	10	1	GL
V.M.&P. NAPHTHA	REDUCER	180122	7	5	GL
VACUUM PUMP OIL	DUOSEAL HIGH VACUUM PUMP OIL	14589	1	1	QT
VACUUM PUMP OIL	DUOSEAL VACUUM PUMP OIL	147663	1	5	GL
VALCOOL TURN TECH	VALCOOL TURN TECH	181591	1	5	GL
VALVE ACTION PAINT MARKER YELLOW	2F936	181003	1	12	OZN
VARNISH: SPAR	VARNISH:SPAR, WATER RESISTING	148597	9	1	GL

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
VESSEL SOLUTION	1612 WATERMARK VESSEL SOLUTION FOR COULOMETRIC TITRATIONS	178789	1	1	LR
VINYL PHENOLIC	STAYS ON METAL PRIMER CLEAR	179440	3	1	GL
VINYL SCREEN PRINTING INK	LOV-210 HIGH GLOSS VINYL COLOR	41314	1	1	QT
VINYL SCREEN PRINTING INK	LOV-520 HIGH GLOSS VINYL COLOR	41322	1	1	QT
VISCOSITY STANDARD	S60	180436	1	1	PT
VOLATILE ORGANIC COMPOUND	48799-U	180053	1	1	ML
WARM TEMPERATURE REDUCER	DT885, DT870	178965	7	1	GL
WASH & HORNET KILLER	RAID WASP & HORNET KILLER 271	179580	219	14	OZF
WASH & HORNET KILLER	RAID WASP & HORNET KILLER 271	179580	6	17	OZF
WASH & HORNET KILLER	RAID WASP & HORNET KILLER 271	181638	45	14	OZF
WASH PRIMER, PART A	AEROGLAZE 9924A	181790	1	1	QT
WASH PRIMER, PART A	AEROGLAZE 9947A	181793	2	1	QT
WASH PRIMER, PART B	AEROGLAZE 9924B	181791	1	1	PT
WASH PRIMER, PART B	AEROGLAZE 9947B	181794	1	1	PT
WASH PRIMER, PART B	AEROGLAZE 9947B	181794	1	1	QT
WASH V-120	WASH V-120	14999	9	1	GL
WASP & HORNET KILLER	RAID WASP & HORNET KILLER III	148190	2	14	OZF
WASP & HORNET KILLER	RAID WASP & HORNET KILLER III	178580	5	14	OZF
WASP & HORNET KILLER	WASP-FREEZE	181543	11	14	OZN
WASP & HORNET KILLER	WHITMIRE PT515 WASP-FREEZE	178864	13	14	OZF
WASP AND HORNET SPRAY	RESCUE	181180	2	14	OZF
WASP& HORNET KILLER	MISTY ACCUR-SPRAY	182256	24	14	OZN
WASTEWATR CYANIDE AND PHENOL	502	179863	2	1	OZF
WASTEWATR HARDNESS	507	181144	2	500	ML
WATER BASE CATALYZED EPOXY	B70W201 PURE WHITE	148240	4	1	GL
WATER BASED CATALYZED EPOXY	B60V25-SEMI-GLOSS HARDENER	15340	5	1	QT
WATER REDUCIBLE COATING	KILZ 2	179247	2	1	GL
WATER REDUCIBLE COATING	KILZ TOTAL ONE 51652-13001-0	179292	7	1	GL
WATER SOLUTION	POLYWATER LUBRICANT J	179551	5	5	GL
WATER-BASED CUTTING FLUID CONCENTRATE	VALCOOL TURN TECH	178641	1	55	GL
WATER-REDUCIBLE ACRYLIC COATING	B66 T 104 ULTRADEEP BASE	148236	15	1	GL
WATER-REDUCIBLE ACRYLIC COATING	B66 W 101 PURE WHITE	147880	15	1	GL
WATER-REDUCIBLE ACRYLIC COATING	B66 W 102 MIDTONE BASE	148234	7	1	GL
WATER-REDUCIBLE ACRYLIC COATING	B66 W 37 SAFETY YELLOW	148237	4	1	GL
WATER-WAX EMULSION	YELLOW 77 ALL 31 SERIES CATALOG NUMBERS	148613	2	1	QT
WAY OIL	MOBIL VACTRA OIL NO.4	15077	2	55	GL
WEATHERBLOK BAIT	TALON G WEATHERBLOK BAIT	178758	1	12.5	LB
WEED AND BRUSH KILLER	TORDON 101 MIXTURE	148256	1	2.5	GL
WHITE	F-900 TORQUE SEAL	181439	12	4	OZF
WHITE	F-900 TORQUE SEAL	181440	12	4	OZF
WHITE MARKING PAINT	0000160652 / STRIPE WHITE INVERTED TIP MARKER	182198	1	14	OZF
WHITE PAINT	018180 / LESCO TOURNAMENT MARKING PAINT-WHITE	182184	12	18	OZF
WHITE PAINT	95-2400 / PITT-GUARD RAPID-COAT NEUTRAL BASE	182354	2	1	GL
WHITE TRAFFIC MARKING PAINT	1418	181188	2	1	GL
WHITE TRAFFIC MARKING PAINT	1418	181188	12	5	GL
WINDO-WELD PRIMERLESS SUPERFAST URETHANE	P/N 08609	179080	3	10	OZF
WINDSHIELD DE-ICER	1090/ CARQUEST WINDSHIELD DE-ICER	182054	74	12	OZF
WINDSHIELD DE-ICER	AV 3013 /PARTS MASTER QUALITY REPLACEMENT WINDSHIELD DE-ICER	182183	1	12	OZF
WOOD FILLER	SURFACING PUTTY (ALL COLORS)	14692	10	4	OZF
WOOD PRESERVATIVE	CUPRINOL WOOD PRESER.GREEN NO.10 158-0331,158-0849,158-0372	178762	1	5	GL
WOOD PUTTY	DURHAM'S ROCK HARD PUTTY	148056	5	4	LB
WOOD SEAL	CUPRINOL WOOD SEAL	179459	5	1	GL
X-TREME CLEAN	X-TREME CLEAN	182142	2	20	GL
XENON	XENON	181178	1	25	LR
XENON	XENON	181656	1	300	LR
YELLOW MARKING PAINT	0000160652 / STRIPE YELLOW INVERTED TIP MARKER	182209	1	14	OZF
YTTRIA STABILIZED CIRCONIA FIBER OR POWDER PRODUCT	YTTRIA STABILIZED CIRCONIA FIBER OR POWDER PRODUCT	182117	1	1	PT
ZEP ANTI-SEIZE AGENT	F071 / ZEP COOPRI-LUBE PASTE	181960	156	8	OZF
ZEP IRONCLAD CORROSION INHIBITOR	0152/ZEP IRONCLAD	181959	12	24	OZN
ZERO CHARGE ANTI-STATIC DISSIPATOR	1726	179772	12	1	PT
ZINC CLAD ZINC RICH COATINGS	B69A56	178711	1	3.75	GL
ZIRCONIA CERAMIC ADHESIVE	904	181941	2	1	PT
ZYGLO DEVELOPER ZP-9F	ZYGLO DEVELOPER ZP-9F	148107	1	12	OZF
	02002 HI-TECH TF ELEC CONTACT, 02002 H	63990	2	12	OZF

Table G-1: (continued)					
Item Name	Part Number	MSDS Number	Qty on Site	Container Qty	Container Unit of Measure
	2-26 AEROSOL 02004, 02005, 02005T	63712	2	16	OZF
	ACETIC ACID	83673	1	2	LR
	HYSOL AD2001 (FORMERLY 50-900), 50-900 RW0R	20000	2	5	GL
	PLASTI-DIP	72804	1	12	OZF
	SODIUM HYDROXIDE	58303	1	3	KG
	STARRETT CLEANER	58505	3	16	OZF

APPENDIX H

AEDC Hazardous Waste Streams Summary
CY 2000 - 2005

Table H-1: AEDC Hazardous Waste Streams Summary										
WS#	**R/NR ***	**WASTE**	**SOURCE**	**RY04 ANNUAL REPORT EPA CODES**	**CY00 Kg**	**CY01 Kg**	**CY02 Kg**	**CY03 Kg**	**CY04 Kg**	**CY05 Kg**
1	R	Isopropanol	ETF Turbine Engine Testing	D001	0	0	0	0	0	0
2	R	Varsol/Solvents	Small Engine Repair	--------	0	0	0	0	0	0
6	R	Sulfuric Acid	Model Shop Chrome Plating	D002	3510	0	476	38	0	0
8	N	Sodium Hydroxide Clean Solution	Caustic Clean @ Model Shop	D002	3038	0	78	1422	57	1220
11	R	Waste Freon	Mark I Optics Cleaning	--------	0	0	0	0	0	0
13	R	Waste PCE	Model Shop Vapor Degreaser	--------	0	0	0	0	0	0
14	R	PCE/Sludge	Model Shop Vapor Degreaser	--------	0	0	0	0	0	0
15	R	TCE	ETF Refrigeration System	D040	34	5511	0	0	0	0
16	N	Water/Methylene Chloride	RC-1 Cooler Lines Flushing	--------	0	0	0	0	0	0
17	R	1,1,1-TCA	Ranges-Clean Launch Tubes	--------	0	0	0	0	0	0
18	R	Wash Water w/Lead	Auto Maintenance Shop Cleaning	D006,D008,D039, F001	0	0	95	0	0	0
19	R	Paint Mixture	Paint Shop Cleaning	D001,D005,D007, D008,F003,F005	1715	829	756	1289	1264	1203
23	R	Nitric/HF Acid Mix	Model Shop Acid Cleaning	D002,D006, D007,D008	0	5620	0	2008	0	2178
24	R	Phosphoric Acid (TURCO)	Model Shop Acid Cleaning	D002,D006, D007,D008	0	0	0	2670	0	0
25	R	Hydrochloric Acid	Model Shop Acid Clean	D007	0	0	0	79	0	0
26	N	Waste Freon	ETF Refrigeration System	--------	0	0	0	0	0	0
28	R	Hydrazines	ETF J3/J4 Testing	D001,U098,U133	151	0	78	0	0	0
29	R	1,1,1-TCA/Freon	Model Shop Parts Cleaning	D008,F001	180	156	0	0	600	0
30	R	Reactive Waste	Unserviceable Explosives	D003	0	0	0	681	0	0
31	R	Styrene Monomers	ETF J4 Liner Resin	--------	0	0	0	0	0	0
32	N	Waste Paint	Abandoned Paint Waste Found On Site	D001,D005	81	188	181	121	234	108
35	R	Ferric Chloride	VKF Shop Circuit Board	--------	0	0	0	0	0	0

*Recurring or Non-Recurring

Table H-1: (continued)										
WS#	**R/NR ***	**WASTE**	**SOURCE**	**RY04 ANNUAL REPORT EPA CODES**	**CY00 Kg**	**CY01 Kg**	**CY02Kg**	**CY03 Kg**	**CY04Kg**	**CY05 Kg**
37	R	Sodium Bichromate/Sulfuric Acid	Photo Lab Processor	--------	0	0	0	0	0	0
38	N	Barium Perchlorate Rinse Water	ETF Test Operations	--------	0	0	0	0	0	0
41	N	Mercury	Spill Clean Up	D008,D009	10	455	0	0	0	0
42	R	Used Oil w/Lead	Lead Contaminated Oil @ Hobby Shop/Motor Pool Areas	D006,D008,D039, F001	0	239	0	0	0	0
43	R	Anodizing Dye	Model Shop Metal Heat Treatment	D002,D007,D008	0	0	1329	0	0	0
45	R	Waste Acid Sludge	Model Shop Cleaning Pit	D006,D007,D008	0	0	0	704	0	0
46	N	TCE Spill Residue	ETF Spill Residue	D008,D040	61	2328	0	0	0	0
52	N	Cooling Water/Oil/Lead	VKF Cooling System Maintenance	D004,D008,D010, D011	0	143	0	0	0	0
53	R	PCE	VKF Parts Washing	--------	0	0	0	0	0	0
54	R	1,1,1-TCA	PWT Degreasing	--------	0	0	0	0	0	0
55	N	Isopropyl Alcohol	A/C Cleaning Cooler Coils-by Model Shop	--------	0	0	0	0	0	0
57	R	Freon (TF113)	ETF Oxidizer System Cleaning	--------	0	0	0	0	0	0
65	R	Versatec Dispersant	Office Machine Repair	--------	0	0	0	0	0	0
66	R	Fiberglass w/Arsenic	VKF Blade Repair w/Arsenic Binder	--------	0	0	0	0	0	0
68	R	Naphtha/Toluene/MEK	VKF Blade Repair Parts Cleaning	--------	0	0	0	0	0	0
72	R	Wash Water w/Metals	Paint Shop Spray Operations	D008	1562	0	0	0	1989	0
75	R	Waste Xylene	16S Control Rm Circuit Board	--------	0	0	0	0	0	0
76	R	Used Oil/Lead/ Halogenated Hydrocarbons	Mixed Contaminated Oil-Basewide	D001,D008,D022, D040,F002,F005	296	401	1462	2070	230	92
77	R	Used Oil/ Water/Sludge	WOMF-Oil w/Solvents and Metals	D039	0	0	14941	0	0	00
80	N	Isopropanol/1,1,1-TCA	APTU Solvent Cleaning By CE	--------	0	0	0	0	0	0
82	R	Waste JP Fuel/Sludge	Storage Tanks Cleaning	D001	0	0	0	25	0	0
85	R	Ethylene Glycol/TCE	ETF B Plant Cooler System	D006D008.D040	0	69	260	0	0	0
87	N	Spent Sulfamic Acid	A/C System Maintenance-B/wide by SD @ Acid Clean Area	D002	624	0	1017	0	0	82

*Recurring or Non-Recurring

Table H-1: (continued)										
WS#	R/NR *	WASTE	SOURCE	RY04 ANNUAL REPORT EPA CODES	CY00 Kg	CY01 Kg	CY02Kg	CY03 Kg	CY04Kg	CY05 Kg
89	R	Used Oil/TCA/TCE	VKF System Maintenance	--------	0	0	0	0	0	0
91	N	Freon/Used Oil	ETF AC&T Maintenance	F001,U075	0	0	0	0	0	0
92	R	Freon/Used Oil	ETF AC&T Flush Oil Lines	--------	0	0	0	0	0	0
94	R	Waste Coolant/1,1,1-TCA	Model Shop Machine Coolant	D008	0	177	0	229	0	0
95	R	Waste Varsol/LX (Mineral Spirits)	Office Machine Repair	--------	0	0	0	0	0	0
97	R	Freon/Used Oil	A/C Shop Chiller Repair by SD	D022,D040,F001, F002	165	0	0	0	0	0
99	N	Used Oil	PWT Cleaning	--------	0	0	0	0	0	0
101	R	Solvent/Oil	PWT Degreasing	--------	0	0	0	0	0	86
106	N	1,1,1-TCA	ETF J4 Off-Spec Solvent	--------	0	0	0	0	0	0
108	R	Used Oil Sludge	PWT Oil Sludge	D006,D007,D008	2819	3421	5546	5458	8755	2135
109	N	TCE/Water (USE WS #46)	ASTF Spill Residue	--------	0	0	0	0	0	0
111	N	Jet Fuel Soaked Wood Chips (USE WS #82)	ETF Fuel Dehydrator Leakage	--------	0	0	0	0	0	0
113	R	Waste AA Standards in Acid	Chem Lab Analytical Waste	D002,D006,D007, D008,D009,D011	100	95	87	163	77	0
114	R	Waste Chlorinated Solvents	Chem Lab Analysis	D001,D040,F002, F003	154	0	111	35	0	98
117	R	Soda Lime Filter Solids	Mark I Spent Fluorine Scrubber	--------	0	0	0	0	0	0
118	R	Waste Solvents	PMEL Gauge Cleaning	D001,F003	0	80	0	0	3	0
120	R	Varsol	ETF Metal Parts Cleaning	--------	0	0	0	0	0	0
121	R	Calcium Sulfate/TCE	ETF C-Plant Dryer Desiccant Change	--------	0	0	0	0	0	0
123	N	LabP Waste Chemicals	Small Quantity-(Project Waste)	LabP Varies	165	1185	1882	2508	486	395
124	R	1,1,1-TCA	VKF Cleaning Tanks	--------	0	0	0	0	0	0
126	R	1,1,1-TCA Degreaser	HTL Degreasing Parts	--------	0	0	0	0	0	0
128	N	1,1,1-TCA/Water	Power Control/ETF Cleaning Tanks (Project Waste)	--------	00	0	0	0	0	0
129	N	Tetrachloroethylene/ Water/Oil	Model Shop Parts Cleaning	--------	0	0	0	0	0	606
132	R	1,1,1-TCA/Water	VKF Cleaning Tanks	--------	0	0	0	0	0	0
133	N	Adhesive/Epoxies	Model Shop Outdated Material	--------	0	0	0	0	0	0
134	N	Beryllium	G-Range Test Operations	--------	0	0	0	0	0	0
135	N	TCE Residue	Whse 6-TCE Spill Residue	--------	0	0	0	0	0	0

*Recurring or Non-Recurring

Table H-1: (continued)										
WS#	R/NR *	WASTE	SOURCE	RY04 ANNUAL REPORT EPA CODES	CY00 Kg	CY01 Kg	CY02Kg	CY03 Kg	CY04Kg	CY05 Kg
			Clean							
136	N	1,1,1-TCA/ Oil	VKF Contaminated Oil	--------	0	0	0	0	0	0
137	N	Lead Based Paint Grit	Sandblast Lead Paint - (Project Waste)	D005,D007,D008	285	903	660	3630	2252	7807
138	R	PCE/Oil	Model Shop Perchloroethylene	--------	0	0	0	0	0	0
139	R	Waste Title-Clad Paint	Outdated Paint Waste	--------	0	0	0	0	0	0
143	N	Used Oil Sludge	One Time Clean Out Of Hone Facility At G-Range	--------	0	0	0	0	0	0
144	N	1,1,1-TCA/Water	Bldg.#2220 Pumping Sump	--------	0	0	0	247	0	0
145	R	Latex Paint	Paint Shop Clean Out	D005	623	127	671	0	186	138
146	R	PCE Waste	Excess Outdated Material	--------	0	0	0	0	0	0
147	R	Corrosive Acid w/TC Metals	Model Shop Acid Cleaning	--------	0	0	0	0	0	0
148	R	Ignitable Isopropanol/Water	PMEL Solvent Cleaning	--------	0	0	0	0	0	0
150	N	Lead Sheathing w/Asbestos	Roof Repair (Project Waste)	D008	323	0	22840	0	0	0
151	R	Waste Gasoline/Water	Fuel Farm/Motor Pool Storage Tank Cleaning (Project Waste)	D001	2143	77	501	0	0	0
152	R	Sodium Hydroxide	Power Control/PWT Electrolyte Solution by SD (Project Waste)	D007	110	0	0	0	1398	0
153	R	Varsol/Kerosene Solvents	Mark I Cleaning	--------	0	0	0	0	0	0
154	N	Solvent Contaminated Soil and/or Water	IRP Activities (Project Waste)	D039,D040,F001, F002	13781	1154	6214	1045	306	10791
155	R	Ferric Cyanide	Photo Lab Processor	--------	0	0	0	0	0	0
156	R	Waste Freon/Nitrogen Tetroxide	ETF J3/J4 Oxidizer Lines Cleaning	D002,F002,P078	0	0	0	1400	0	0
158	R	Batteries	Unserviceable Batteries	D001,D007	58	2091	20	19	0	0
161	R	Used Oil Contaminated w/Chlorinated Solvents	ETF Contaminated Used Oil	D040	575	210	169	216	188	324
162	R	Photoreceptor Copier Drums w/Selenium & Arsenic	Office Machine Repair	--------	0	0	0	0	0	0
166	R	Polyethylene Pistons Containing Lead	G-Range Test Operations	--------	0	0	0	0	0	0
167	N	Fuller Earth Contaminated with Chloroform	Basewide Transformer Retrofill by SD (Project Waste)	--------	0	0	0	0	0	0
168	N	Contaminated Waste Water	ETF Test Operations	--------	0	0	0	0	0	91

*Recurring or Non-Recurring

Table H-1: (continued)										
WS#	**R/NR ***	**WASTE**	**SOURCE**	**RY04 ANNUAL REPORT EPA CODES**	**CY00 Kg**	**CY01 Kg**	**CY02Kg**	**CY03 Kg**	**CY04Kg**	**CY05 Kg**
169	R	Laser Dye	ETF Laser Lab	D001,D039	0	0	0	0	97	0
170	R	Contaminated Storage Tank Sludge	ETF Refrigeration Clean Storage Tanks by SD (Project Waste)	--------	0	0	0	0	0	0
171	R	Fluorescent Light Bulbs	Base-wide Bulb Change-out	--------	0	0	0	0	0	0
172	R	Photographic Silver Recovery Effluent Solution	Photo Lab/X-Ray Lab	D007,D011	0	0	53	0	0	0
173	R	Water w/Floor Stripper or Finishes	USAI Janitorial	D008	0	618	0	0	0	0
174	R	Wood Treated with Arsenic	Cooling Towers (Project Waste)	--------	0	0	0	0	0	0
175	N	Test Facility Wash Water	Maintenance/Cleaning Test Facilities	D002,D006,D008	911	5000	0	3979	605	0
176	R	Still Bottoms from Paint Thinner Recycling	Paint Shop Distillation Unit	F003,F005	0	0	0	0	28	0
177	N	Contaminated Glycol and Water	A/C Shop Cooling Water Systems	D007,D008	0	0	0	0	881	314
					33,474	31,077	59,479	30,036	19,636	27,668

*Recurring or Non-Recurring

APPENDIX I

Toxic Release Inventory Reports
CY 2002-2004

Toxic Release Inventory Report
CY 2002

STAFF SUMMARY SHEET

	TO	ACTION	SIGNATURE (Surname), GRADE AND DATE		TO	ACTION	SIGNATURE (Surname), GRADE AND DATE
1	JA	Coord.	Hart, Lt Col, USAFR 6 June 03	6	SDE	Action	
2	SD	Coord.	9 June 03	7			
3	CCE	Coord.	TANK 11 JUN 03	8			
4	CCS	Coord.	11 Jun 03	9			
5	CV	Sign	6/11/03	10			

SURNAME OF ACTION OFFICER AND GRADE	SYMBOL	PHONE	TYPIST'S INITIALS	SUSPENSE DATE
LE, GS-12	SDE	5873	cm	20030618

SUBJECT	DATE
AEDC Toxic Release Inventory	20030604

SUMMARY

1. The Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 and the Pollution Prevention Act of 1990 requires facilities which exceed threshold quantities specified in 40 CFR 372 (Toxic Release Inventory Reporting; Community Right to Know) to report quantities of toxic chemical releases. For reporting calendar year (CY) 2002, two chemicals exceeded the reporting thresholds. The two chemicals are ethylene glycol and dichlorodifluoromethane (R12).

2. Approximately 53,300 pounds of ethylene glycol were released during CY2002 and approximately 850 pounds of the waste materials transferred off site. The release of 53,300 pounds during CY2002 was an increase from the quantity released during CY2001, which was 47,000 pounds. The increase for CY2002 can be attributed to the fact that system sump levels were not replenished in 2001 (allowed to get to minimum levels) but were replenished before testing began in 2002.

3. Approximately 12,900 pounds of R12 were released during CY2002. A 6,000-pound spill that occurred in July 2002 required replacement chemical. The additional 6,900 pounds were system makeup, which equates to an annual leak rate of 14% due to "normal" leakage. This R12 system contains approximately 46,000 pounds. R12 was last reported by AEDC under these regulations in CY1998.

4. The electronic submittal must be forwarded to the EPA and a paper copy to the Tennessee Emergency Management Agency (TEMA) prior to 1 July 2003.

RECOMMENDATION

5. CV sign the "Certification Statement" at Tabs 2 and 3.

FRANK A. DUNCAN
Deputy Chief, Environmental Mgmt Division
Support Directorate

3 TABS
1. Transmittal Letters
2. Ethylene Glycol Form R
3. Dichlorodifluomethane Form R

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS ARNOLD ENGINEERING DEVELOPMENT CENTER (AFMC)
ARNOLD AIR FORCE BASE, TENNESSEE

18 June 2003

AEDC/SDE
100 Kindel Drive
Arnold AFB TN 37389-1228

EPCRA Reporting Center
ATTN: TRI Magnetic Media Submission
TRI Data Processing Center
c/o Computer Sciences Corporation
8400 Corporate Drive, Suite 300
New Carrollton MD 20785

Dear Sir/Madam,

Enclosed please find one (1) diskette containing toxic chemical release reporting information for Arnold Engineering Development Center (AEDC). This information is submitted as required under Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 and the Pollution Prevention Act of 1990.

A total of two (2) reports are included from our facility, concerning the following chemicals:

Chemical Name	RY	CAS Number
Ethylene Glycol	2002	107-21-1
Dichlorodifluoromethane	2002	75-71-8

Our technical point of contact is Mr. Charles H. King. Mr. King is available at (931) 454-7743 should any questions or problems arise as you process the diskette.

Sincerely,

FRANK A. DUNCAN
Deputy Chief, Environmental Mgmt. Division
Support Directorate

Attachment:
Form R Diskette

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS ARNOLD ENGINEERING DEVELOPMENT CENTER (AFMC)
ARNOLD AIR FORCE BASE, TENNESSEE

18 June 2003

AEDC/SDE
100 Kindel Drive
Arnold AFB TN 37389-1228

Ms. Betty Eaves
Tennessee Emergency Response Council
c/o Tennessee Emergency Management Agency (TEMA)
3041 Sidco Drive
Nashville TN 37204-1502

Dear Ms. Eaves,

Enclosed please find two (2) Toxic Release Inventory reports containing toxic chemical release information for Arnold Engineering Development Center (AEDC). This information is submitted as required under Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 and the Pollution Prevention Act of 1990.

A total of two (2) reports are included from our facility, concerning the following chemicals:

Chemical Name	RY	CAS Number
Ethylene Glycol	2002	107-21-1
Dichlorodifluoromethane	2002	75-71-8

Our technical point of contact is Mr. Charles H. King. Mr. King is available at (931) 454-7743 should any questions or problems arise.

Sincerely,

FRANK A. DUNCAN
Deputy Chief, Environmental Mgmt Division
Support Directorate

Attachments:
1. Form R Package (Ethylene Glycol)
2. Form R Package (Dichlorodifluoromethane)

EPA
United States Environmental Protection Agency

FORM R

TOXIC CHEMICAL RELEASE INVENTORY REPORTING FORM

Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986, also known as Title III of the Superfund Amendments and Reauthorization Act

WHERE TO SEND COMPLETED FORMS: 1. TRI Data Processing Center P.O.Box 1513 Lantham, MD 20703-1513 2. APPROPRIATE STATE OFFICE (See instructions in Appendix F)

Enter "X" here if this is a revision

For EPA use only

Important: See instructions to determine when "Not Applicable (NA)" boxes should be checked.

PART I. FACILITY IDENTIFICATION INFORMATION

SECTION 1. REPORTING YEAR 2002

SECTION 2. TRADE SECRET INFORMATION

2.1	Are you claiming the toxic chemical identified on page 2 trade secret? [ ] Yes (Answer question 2.2; Attach substantiation forms) [X] NO (Do not answer 2.2; Go to Section 3)	2.2	Is this copy [ ] Sanitized [ ] Unsanitized (Answer only if "YES" in 2.1)

SECTION 3. CERTIFICATION (Important: Read and sign after completing all form sections.)

I hereby certify that I have reviewed the attached documents and that, to the best of my knowledge and belief, the submitted information is true and complete and that the amounts and values in this report are accurate based on reasonable estimates using data availble to the preparers of this report.

Name and official title of owner/operator or senior management official:	Signature:	Date Signed:
LARRY V. JUDGE CAPT, USN VICE COMMANDER	Larry V. Judge	06/18/2003

SECTION 4. FACILITY IDENTIFICATION

4.1	TRI Facility ID Number: 37389RNLDN100KI
Facility or Establishment Name: U.S. DOD USAF ARNOLD AFB, TN	Facility or Establishment Name or Mailing Address (if different from street address):
Street: 100 KINDEL DRIVE	Mailing Addres: NA
City/County/State/Zip Code: ARNOLD AFB COFFEE TN 37389-1228	City/State/Zip Code: Country (Non-U

4.2	This report contains information for: (Important: check a or b; check c or d if applicable)	a. [X] An entire facility b. [ ] Part of a facility c. [X] A Federal facility d. [ ] GOCO
4.3	Technical Contact Name: CHARLES KING	Telephone Number (include area code): (931) 454-7743
	Email Address: charles.king@arnold.af.mil	
4.4	Public Contact Name: T.L. WHITE, CAPTAIN	Telephone Number (include area code): (931) 454-4204

		Primary					
4.5	SIC Code (s) (4 digits)	a. 9711	b.	c.	d.	e.	f.

		Degrees	Minutes	Seconds		Degrees	Minutes	Seconds
4.6	Latitude	35	22	30	Longitude	086	02	30

4.7 Dun & Bradstreet Number(s) (9 digits)	4.8 EPA Identification Number (RCRA I.D. No.) (12 characters)	4.9 Facility NPDES Permit Number(s) (9 characters)	4.10 Underground Injection Well Code (UIC) I.D. Number(s) (12 digits)
a. NA	a. TN8570024044	a. TN0003751	a. NA
b.	b.	b.	b.

SECTION 5. PARENT COMPANY INFORMATION

5.1	Name of Parent Company	NA [ ]	US DEPARTMENT OF DEFENSE
5.2	Parent Company's Dun & Bradstreet Number	NA [X]	

EPA FORM R PART II. CHEMICAL - SPECIFIC INFORMATION	TRI Facility ID Number: 37389RNLDN100KI
	Toxic Chemical, Category or Generic Name: Ethylene glycol

SECTION 1. TOXIC CHEMICAL IDENTITY

(Important: DO NOT complete this section if you completed Section 2 below.)

1.1	CAS Number (Important: Enter only one number exactly as it appears on the Section 313 list. Enter category code if reporting a chemical category.) 107-21-1
1.2	Toxic Chemical or Chemical Category Name (Important: Enter only one name exactly as it appears on the Section 313 list.) Ethylene glycol
1.3	Generic Chemical Name (Important: Complete only if Part 1, Section 2.1 is checked "Yes". Generic Name must be structurally descriptive.) NA

1.4 Distribution of Each Member of the Dioxin and Dioxin-like Compounds Category.
(If there are any numbers in boxes 1-17, then every field must be filled in with either 0 or some number between 0.01 and 100. Distribution should be reported in percentages and the total should equal 100%. If you do not have speciation data available, indicate NA.)

NA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

SECTION 2. MIXTURE COMPONENT IDENTITY

(Important: DO NOT complete this section if you completed Section 1 above.)

2.1 Generic Chemical Name Provided by Supplier (Important: Maximum of 70 characters, including numbers, letters, spaces, and punctuation.)
NA

SECTION 3. ACTIVITIES AND USES OF THE TOXIC CHEMICAL AT THE FACILITY

(Important: Check all that apply.)

3.1 Manufacture the toxic chemical	3.2 Process the toxic chemical:	3.3 Otherwise use the toxic chemical:
a. [ ] Produce b. [ ] Import		
If produce or import:	a. [ ] As a reactant	a. [ ] As a chemical processing aid
c. [ ] For on-site use/processing	b. [ ] As a formulation component	b. [ ] As a manufacturing aid
d. [ ] For sale/distribution	c. [ ] As an article component	c. [X] Ancillary or other use
e. [ ] As a byproduct	d. [ ] Repackaging	
f. [ ] As an impurity	e. [ ] As an impurity	

SECTION 4. MAXIMUM AMOUNT OF THE TOXIC CHEMICAL ONSITE AT ANY TIME DURING THE CALENDAR YEAR

4.1 05 (Enter two-digit code from instruction package.)

SECTION 5. QUANTITY OF THE TOXIC CHEMICAL ENTERING EACH ENVIRONMENTAL MEDIUM ONSITE

		NA	A. Total Release (pounds/year*) (Enter range code or estimate**)	B. Basis of Estimate (enter code)	C. % From Stormwater
5.1	Fugitive or non-point air emissions	X			
5.2	Stack or point air emissions		14800	O	
5.3	Discharges to receiving streams or water bodies (enter one name per box)				
	Stream or Water Body Name				
5.3.1	Rowland		38500	O	0
5.3.2					
5.3.3					

If additional pages of Part II, Section 5.3 are attached, indicate the total number of pages in this box [ ]
and indicate the Part II, Section 5.3 page number in this box. [ ] (example: 1,2,3, etc.)

* For Dioxin or Dioxin-like compounds, report in grams/year

** Range Codes: A= 1- 10 pounds; B= 11- 499 pounds; C= 500 - 999 pounds.

EPA FORM R

PART II. CHEMICAL - SPECIFIC INFORMATION (CONTINUED)

TRI Facility ID Number	Toxic Chemical, Category, or Generic Name
37389RNLDN100KI	Ethylene glycol

SECTION 5. QUANTITY OF THE TOXIC CHEMICAL ENTERING EACH ENVIRONMENTAL MEDIUM ONSITE (Continued)

		NA	A. Total Release (pounds/year*) (enter range code** or estimate)	B. Basis of Estimate (enter code)
5.4.1	Underground Injection onsite to Class I Wells	X		
5.4.2	Underground Injection onsite to Class II-V Wells	X		
5.5	Disposal to land onsite			
5.5.1.A	RCRA Subtitle C landfills	X		
5.5.1.B	Other landfills	X		
5.5.2	Land treatment/application farming	X		
5.5.3	Surface Impoundment	X		
5.5.4	Other disposal	X		

SECTION 6. TRANSFERS OF THE TOXIC CHEMICAL IN WASTES TO OFF-SITE LOCATIONS

6.1 DISCHARGES TO PUBLICLY OWNED TREATMENT WORKS (POTWs)

6.1.A Total Quantity Transferred to POTWs and Basis of Estimate

6.1.A.1. Total Transfers (pounds/year*) (enter range code** or estimate)	6.1.A.2 Basis of Estimate (enter code)
NA	

6.1.B 1	POTW Name	NA					
POTW Address							
City		State		County		Zip	

6.1.B	POTW Name						
POTW Address							
City		State		County		Zip	

If additional pages of Part II, Section 6.1 are attached, indicate the total number of pages in this box [ ] and indicate the Part II, Section 6.1 page number in this box [ ] (example: 1,2,3, etc.)

SECTION 6.2 TRANSFERS TO OTHER OFF-SITE LOCATIONS

6.2. 1 Off-Site EPA Identification Number (RCRA ID No.)	FLD980559728								
Off-Site Location Name	PERMA-FIX OF ORLANDO								
Off-site Address	10100 ROCKET BLVD.								
City	ORLANDO	State	FL	County	ORANGE	Zip	32824	Country (Non-US)	
Is location under control of reporting facility or parent company?					[ ] Yes		X No		

* For Dioxin or Dioxin-like compounds, report in grams/year

** Range Codes: A= 1- 10 pounds; B= 11- 499 pounds; C= 500 - 999 pounds.

EPA FORM R

PART II. CHEMICAL - SPECIFIC INFORMATION (CONTINUED)

TRI Facility ID Number	37389RNLDN100KI
Toxic Chemical, Category, or Generic Name	Ethylene glycol

SECTION 6.2 TRANSFERS TO OTHER OFF-SITE LOCATIONS (Continued)

A. Total Transfers (pounds/year*) (enter range code** or estimate)	B. Basis of Estimate (enter code)	C. Type of Waste Treatment/Disposal/ Recycling/Energy Recovery (enter code)
1. 32	1. M	1. M64
2. 844	2. M	2. M61
3. NA	3.	3.
4.	4.	4.

6.2. Off-Site EPA Identification Number (RCRA ID No.)	
Off-Site location Name	
Off-site Address	

City		State		County		Zip		Country (Non-US)	

Is location under control of reporting facility or parent company? ☐ Yes ☐ No

A. Total Transfers (pounds/year*) (enter range code** or estimate)	B. Basis of Estimate (enter code)	C. Type of Waste Treatment/Disposal/ Recycling/Energy Recovery (enter code)
1.	1.	1.
2.	2.	2.
3.	3.	3.
4.	4.	4.

SECTION 7A. ONSITE WASTE TREATMENT METHODS AND EFFICIENCY

X Not Applicable (NA) - Check here if no on-site waste treatment is applied to any waste stream containing the toxic chemical or chemical category.

a. General Waste Stream (enter code)	b. Waste Treatment Method(s) Sequence [enter 3-character code(s)]	c. Range of Influent Concentration	d. Waste Treatment Efficiency Estimate	e. Based on Operating Data ?
7A.1a	7A.1b 1 2 3 4 5 6 7 8	7A.1c	7A.1d %	7A.1e Yes No
7A.2a	7A.2b 1 2 3 4 5 6 7 8	7A.2c	7A.2d %	7A.2e Yes No
7A.3a	7A.3b 1 2 3 4 5 6 7 8	7A.3c	7A.3d %	7A.3e Yes No
7A.4a	7A.4b 1 2 3 4 5 6 7 8	7A.4c	7A.4d %	7A.4e Yes No
7A.5a	7A.5b 1 2 3 4 5 6 7 8	7A.5c	7A.5d %	7A.5e Yes No

If additional pages of Part II, Section 6.2/7A are attached, indicate the total number of pages in this box ☐ and indicate the Part II, Section 6.2/7A page number in this box: ☐ (example: 1,2,3, etc.)

* For Dioxin or Dioxin-like compounds, report in grams/year

** Range Codes: A= 1- 10 pounds; B= 11- 499 pounds; C= 500 - 999 pounds.

EPA FORM R PART II. CHEMICAL-SPECIFIC INFORMATION (CONTINUED)	TRI Facility ID Number
	37389RNLDN100KI
	Toxic Chemical, Category, or Generic Name
	Ethylene glycol

SECTION 7B. ON-SITE ENERGY RECOVERY PROCESSES

[X] Not Applicable (NA) - Check here if no on-site energy recovery is applied to any waste stream containing the toxic chemical or chemical category.

Energy Recovery Methods [enter 3-character code(s)]

1 ____ 2 ____ 3 ____ 4 ____

SECTION 7C. ON-SITE RECYCLING PROCESSES

[X] Not Applicable (NA) - Check here if no on-site recyling is applied to any waste stream containing the toxic chemical or chemical category.

Recycling Methods [enter 3-character code(s)]

1 ____ 2 ____ 3 ____ 4 ____ 5 ____

6 ____ 7 ____ 8 ____ 9 ____ 10 ____

SECTION 8. SOURCE REDUCTION AND RECYCLING ACTIVITIES

		Column A Prior Year (pounds/year*)	Column B Current Reporting Year (pounds/year*)	Column C Following Year (pounds/year*)	Column D Second Following Year (pounds/year*)
8.1	Quantity released ***	47000	53300	50000	50000
8.2	Quantity used for energy recovery onsite	NA	NA	NA	NA
8.3	Quantity used for energy recovery offsite	NA	NA	NA	NA
8.4	Quantity recycled onsite	NA	NA	NA	NA
8.5	Quantity recycled offsite	NA	NA	NA	50000
8.6	Quantity treated onsite	NA	NA	NA	NA
8.7	Quantity treated offsite	NA	850	400	800
8.8	Quantity released to the environment as a result of remedial actions, catastrophic events, or one-time events not associated with production processes (pounds/year)			NA	
8.9	Production ratio or activity index			1.00	

8.10	Did your facility engage in any source reduction activities for this chemical during the reporting year? If not, enter "NA" in Section 8.10.1 and answer Section 8.11.			
	Source Reduction Activities [enter code(s)]	Methods to Identify Activity (enter codes)		
8.10.1	NA	a.	b.	c.
8.10.2		a.	b.	c.
8.10.3		a.	b.	c.
8.10.4		a.	b.	c.
8.11	Is additional information on source reduction, recycling, or pollution control activities included with this report ? (Check one Box)		Yes [ ]	No [X]

EPA Form 9350-1 (Rev. 03/2003) - Previous editions are obsolete.

*For Dioxin or Dioxin-like compounds, report in grams/year

***Report releases pursuant to EPCRA Section 329 (8) including "any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment." Do not include any quantity treated onsite.

EPA
United States
Environmental Protection
Agency

FORM R

TOXIC CHEMICAL RELEASE
INVENTORY REPORTING FORM

Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986, also known as Title III of the Superfund Amendments and Reauthorization Act

WHERE TO SEND COMPLETED FORMS: 1. TRI Data Processing Center, P.O.Box 1513, Lantham, MD 20703-1513 2. APPROPRIATE STATE OFFICE (See instructions in Appendix F)

Enter "X" here if this is a revision

For EPA use only

Important: See instructions to determine when "Not Applicable (NA)" boxes should be checked.

PART I. FACILITY IDENTIFICATION INFORMATION

SECTION 1. REPORTING YEAR 2002

SECTION 2. TRADE SECRET INFORMATION

2.1	Are you claiming the toxic chemical identified on page 2 trade secret? [ ] Yes (Answer question 2.2; Attach substantiation forms) [X] NO (Do not answer 2.2; Go to Section 3)	2.2	Is this copy [ ] Sanitized [ ] Unsanitized (Answer only if "YES" in 2.1)

SECTION 3. CERTIFICATION (Important: Read and sign after completing all form sections.)

I hereby certify that I have reviewed the attached documents and that, to the best of my knowledge and belief, the submitted information is true and complete and that the amounts and values in this report are accurate based on reasonable estimates using data availble to the preparers of this report.

Name and official title of owner/operator or senior management official:	Signature:	Date Signed:
LARRY V. JUDGE CAPT, USN VICE COMMANDER	Larry V. Judge	06/18/2003

SECTION 4. FACILITY IDENTIFICATION

4.1 TRI Facility ID Number: 37389RNLDN100KI

Facility or Establishment Name	Facility or Establishment Name or Mailing Address (if different from street address)
U.S. DOD USAF ARNOLD AFB, TN	
Street: 100 KINDEL DRIVE	Mailing Addres: NA
City/County/State/Zip Code: ARNOLD AFB COFFEE TN 37389-1228	City/State/Zip Code: ; Country (Non-U

4.2 This report contains information for: (Important: check a or b; check c or d if applicable) a. [X] An entire facility b. [ ] Part of a facility c. [X] A Federal facility d. [ ] GOCO

4.3	Technical Contact Name	CHARLES KING	Telephone Number (include area code): (931) 454-7743
	Email Address	charles.king@arnold.af.mil	
4.4	Public Contact Name	T.L. WHITE, CAPTAIN	Telephone Number (include area code): (931) 454-4204

		Primary					
4.5	SIC Code (s) (4 digits)	a. 9711	b.	c.	d.	e.	f.

		Degrees	Minutes	Seconds		Degrees	Minutes	Seconds
4.6	Latitude	35	22	30	Longitude	086	02	30

4.7 Dun & Bradstreet Number(s) (9 digits)	4.8 EPA Identification Number (RCRA I.D. No.) (12 characters)	4.9 Facility NPDES Permit Number(s) (9 characters)	4.10 Underground Injection Well Code (UIC) I.D. Number(s) (12 digits)
a. NA	a. TN8570024044	a. TN0003751	a. NA
b.	b.	b.	b.

SECTION 5. PARENT COMPANY INFORMATION

5.1	Name of Parent Company	NA [ ]	US DEPARTMENT OF DEFENSE
5.2	Parent Company's Dun & Bradstreet Number	NA [X]	

EPA FORM R PART II. CHEMICAL - SPECIFIC INFORMATION	TRI Facility ID Number: 37389RNLDN100KI
	Toxic Chemical, Category or Generic Name: Dichlorodifluoromethane (CFC-12)

SECTION 1. TOXIC CHEMICAL IDENTITY
(Important: DO NOT complete this section if you completed Section 2 below.)

1.1	CAS Number (Important: Enter only one number exactly as it appears on the Section 313 list. Enter category code if reporting a chemical category.) 75-71-8
1.2	Toxic Chemical or Chemical Category Name (Important: Enter only one name exactly as it appears on the Section 313 list.) Dichlorodifluoromethane (CFC-12)
1.3	Generic Chemical Name (Important: Complete only if Part 1, Section 2.1 is checked "Yes". Generic Name must be structurally descriptive.) NA
1.4	**Distribution of Each Member of the Dioxin and Dioxin-like Compounds Category.** (If there are any numbers in boxes 1-17, then every field must be filled in with either 0 or some number between 0.01 and 100. Distribution should be reported in percentages and the total should equal 100%. If you do not have speciation data available, indicate NA.)

NA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

SECTION 2. MIXTURE COMPONENT IDENTITY
(Important: DO NOT complete this section if you completed Section 1 above.)

2.1	Generic Chemical Name Provided by Supplier (Important: Maximum of 70 characters, including numbers, letters, spaces, and punctuation.) NA

SECTION 3. ACTIVITIES AND USES OF THE TOXIC CHEMICAL AT THE FACILITY
(Important: Check all that apply.)

3.1 Manufacture the toxic chemical	3.2 Process the toxic chemical:	3.3 Otherwise use the toxic chemical:
a. [ ] Produce b. [ ] Import		
If produce or import:	a. [ ] As a reactant	a. [ ] As a chemical processing aid
c. [ ] For on-site use/processing	b. [ ] As a formulation component	b. [ ] As a manufacturing aid
d. [ ] For sale/distribution	c. [ ] As an article component	c. [X] Ancillary or other use
e. [ ] As a byproduct	d. [ ] Repackaging	
f. [ ] As an impurity	e. [ ] As an impurity	

SECTION 4. MAXIMUM AMOUNT OF THE TOXIC CHEMICAL ONSITE AT ANY TIME DURING THE CALENDAR YEAR

4.1	05	(Enter two-digit code from instruction package.)

SECTION 5. QUANTITY OF THE TOXIC CHEMICAL ENTERING EACH ENVIRONMENTAL MEDIUM ONSITE

			A. Total Release (pounds/year*) (Enter range code or estimate**)	B. Basis of Estimate (enter code)	C. % From Stormwater
5.1	Fugitive or non-point air emissions	NA [ ]	12900	O	
5.2	Stack or point air emissions	NA [X]			
5.3	Discharges to receiving streams or water bodies (enter one name per box)				
	Stream or Water Body Name				
5.3.1	NA			—	
5.3.2					
5.3.3					

If additional pages of Part II, Section 5.3 are attached, indicate the total number of pages in this box [ ] and indicate the Part II, Section 5.3 page number in this box. [ ] (example: 1,2,3, etc.)

* For Dioxin or Dioxin-like compounds, report in grams/year

** Range Codes: A= 1- 10 pounds; B= 11- 499 pounds; C= 500 - 999 pounds.

EPA FORM R PART II. CHEMICAL - SPECIFIC INFORMATION (CONTINUED)	TRI Facility ID Number 37389RNLDN100KI Toxic Chemical, Category, or Generic Name Dichlorodifluoromethane (CFC-12)

SECTION 5. QUANTITY OF THE TOXIC CHEMICAL ENTERING EACH ENVIRONMENTAL MEDIUM ONSITE (Continued)

		NA	A. Total Release (pounds/year*) (enter range code** or estimate)	B. Basis of Estimate (enter code)
5.4.1	Underground Injection onsite to Class I Wells	X		
5.4.2	Underground Injection onsite to Class II-V Wells	X		
5.5	Disposal to land onsite			
5.5.1.A	RCRA Subtitle C landfills	X		
5.5.1.B	Other landfills	X		
5.5.2	Land treatment/application farming	X		
5.5.3	Surface Impoundment	X		
5.5.4	Other disposal	X		

SECTION 6. TRANSFERS OF THE TOXIC CHEMICAL IN WASTES TO OFF-SITE LOCATIONS

6.1 DISCHARGES TO PUBLICLY OWNED TREATMENT WORKS (POTWs)

6.1.A Total Quantity Transferred to POTWs and Basis of Estimate

6.1.A.1. Total Transfers (pounds/year*) (enter range code** or estimate)	6.1.A.2 Basis of Estimate (enter code)
NA	

6.1.B 1	POTW Name	NA					
POTW Address							
City		State		County		Zip	
6.1.B	POTW Name						
POTW Address							
City		State		County		Zip	

If additional pages of Part II, Section 6.1 are attached, indicate the total number of pages in this box [ ] and indicate the Part II, Section 6.1 page number in this box [ ] (example: 1,2,3, etc.)

SECTION 6.2 TRANSFERS TO OTHER OFF-SITE LOCATIONS

6.2. 1	Off-Site EPA Identification Number (RCRA ID No.)	NA					
Off-Site Location Name	NA						
Off-site Address							
City		State		County		Zip	Country (Non-US)

Is location under control of reporting facility or parent company? [ ] Yes [ ] No

* For Dioxin or Dioxin-like compounds, report in grams/year

** Range Codes: A= 1- 10 pounds; B= 11- 499 pounds; C= 500 - 999 pounds.

EPA FORM R
PART II. CHEMICAL - SPECIFIC INFORMATION (CONTINUED)

TRI Facility ID Number
37389RNLDN100KI
Toxic Chemical, Category, or Generic Name
Dichlorodifluoromethane (CFC-12)

SECTION 6.2 TRANSFERS TO OTHER OFF-SITE LOCATIONS (Continued)

A. Total Transfers (pounds/year*) (enter range code** or estimate)	B. Basis of Estimate (enter code)	C. Type of Waste Treatment/Disposal/ Recycling/Energy Recovery (enter code)
1.	1.	1.
2.	2.	2.
3.	3.	3.
4.	4.	4.

6.2. Off-Site EPA Identification Number (RCRA ID No.)

Off-Site location Name

Off-site Address

City		State		County		Zip		Country (Non-US)	

Is location under control of reporting facility or parent company? ☐ Yes ☐ No

A. Total Transfers (pounds/year*) (enter range code** or estimate)	B. Basis of Estimate (enter code)	C. Type of Waste Treatment/Disposal/ Recycling/Energy Recovery (enter code)
1.	1.	1.
2.	2.	2.
3.	3.	3.
4.	4.	4.

SECTION 7A. ONSITE WASTE TREATMENT METHODS AND EFFICIENCY

X Not Applicable (NA) - Check here if no on-site waste treatment is applied to any waste stream containing the toxic chemical or chemical category.

a. General Waste Stream (enter code)	b. Waste Treatment Method(s) Sequence [enter 3-character code(s)]	c. Range of Influent Concentration	d. Waste Treatment Efficiency Estimate	e. Based on Operating Data ?
7A.1a	7A.1b 1 2 3 4 5 6 7 8	7A.1c	7A.1d %	7A.1e Yes No
7A.2a	7A.2b 1 2 3 4 5 6 7 8	7A.2c	7A.2d %	7A.2e Yes No
7A.3a	7A.3b 1 2 3 4 5 6 7 8	7A.3c	7A.3d %	7A.3e Yes No
7A.4a	7A.4b 1 2 3 4 5 6 7 8	7A.4c	7A.4d %	7A.4e Yes No
7A.5a	7A.5b 1 2 3 4 5 6 7 8	7A.5c	7A.5d %	7A.5e Yes No

If additional pages of Part II, Section 6.2/7A are attached, indicate the total number of pages in this box ☐ and indicate the Part II, Section 6.2/7A page number in this box: ☐ (example: 1,2,3, etc.)

* For Dioxin or Dioxin-like compounds, report in grams/year

** Range Codes: A= 1- 10 pounds; B= 11- 499 pounds; C= 500 - 999 pounds.

EPA FORM R
PART II. CHEMICAL-SPECIFIC INFORMATION (CONTINUED)

TRI Facility ID Number	37389RNLDN100KI
Toxic Chemical, Category, or Generic Name	Dichlorodifluoromethane (CFC-12)

SECTION 7B. ON-SITE ENERGY RECOVERY PROCESSES

[X] Not Applicable (NA) - Check here if no on-site energy recovery is applied to any waste stream containing the toxic chemical or chemical category.

Energy Recovery Methods [enter 3-character code(s)]

1		2		3		4	

SECTION 7C. ON-SITE RECYCLING PROCESSES

[X] Not Applicable (NA) - Check here if no on-site recyling is applied to any waste stream containing the toxic chemical or chemical category.

Recycling Methods [enter 3-character code(s)]

1		2		3		4		5	
6		7		8		9		10	

SECTION 8. SOURCE REDUCTION AND RECYCLING ACTIVITIES

		Column A Prior Year (pounds/year*)	Column B Current Reporting Year (pounds/year*)	Column C Following Year (pounds/year*)	Column D Second Following Year (pounds/year*)
8.1	Quantity released ***	0	6900	7000	7000
8.2	Quantity used for energy recovery onsite	NA	NA	NA	NA
8.3	Quantity used for energy recovery offsite	NA	NA	NA	NA
8.4	Quantity recycled onsite	NA	NA	NA	NA
8.5	Quantity recycled offsite	NA	NA	NA	NA
8.6	Quantity treated onsite	NA	NA	NA	NA
8.7	Quantity treated offsite	NA	NA	NA	NA
8.8	Quantity released to the environment as a result of remedial actions, catastrophic events, or one-time events not associated with production processes (pounds/year)	6000			
8.9	Production ratio or activity index	1.00			

8.10 Did your facility engage in any source reduction activities for this chemical during the reporting year? If not, enter "NA" in Section 8.10.1 and answer Section 8.11.

	Source Reduction Activities [enter code(s)]	Methods to Identify Activity (enter codes)		
8.10.1	NA	a.	b.	c.
8.10.2		a.	b.	c.
8.10.3		a.	b.	c.
8.10.4		a.	b.	c.

8.11 Is additional information on source reduction, recycling, or pollution control activities included with this report ? (Check one Box) Yes [ ] No [X]

*For Dioxin or Dioxin-like compounds, report in grams/year

***Report releases pursuant to EPCRA Section 329 (8) including "any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment." Do not include any quantity treated onsite.

Toxic Release Inventory Report
CY 2003

ENVIRONMENTAL BRANCH DOCUMENT CERTIFICATION FORM

DOCUMENT NAME OR DESCRIPTION	PREPARED BY	DATE PREPARED
Toxic Release Inventory	Letha McEntee	24 May 2004

CDRL ITEM: ☑ YES ☐ NO

REGULATORY CITATION IF APPLICABLE: 40 CFR Part 372

DOCUMENT SUBMITTED TO *(ORGANIZATION OR AGENCY)*

☑ USEPA ☐ AFMC ☑ OTHER *(PLEASE SPECIFY)* TEMA - Tennessee Emergency Management Agency

☐ TDEC ☑ AEDC/SDE

☐ AIR STAFF ☑ ATA

INFORMATION OR DATA WITHIN DOCUMENT THAT WAS CONTRIBUTED BY OTHER ORGANIZATIONS:

ORGANIZATION	DESCRIBE INFORMATION OR DATA *(USE PAGE TWO IF NEEDED)*
FA70	Ethylene glycol usage data

CERTIFICATION LEVEL

CERTIFICATION LEVEL AND DESCRIPTION:

☑ LEVEL I DOCUMENTS CERTIFIED TO A REGULATORY AGENCY.

☐ LEVEL II DOCUMENTS SUBMITTED TO REGULATORY AGENCIES WITHOUT CERTIFICATION AND DOCUMENTS SUBMITTED FOR AIR FORCE USE BEYOND THE LOCAL BASE LEVEL.

CERTIFICATION STATEMENT:

I HAVE REVIEWED THE INFORMATION CONTAINED IN THIS DOCUMENT AND TO THE BEST OF MY KNOWLEDGE AND BELIEF FORMED AFTER REASONABLE INQUIRY, THE INFORMATION IS TRUE, ACCURATE, AND COMPLETE. I AM AUTHORIZED TO MAKE THIS STATEMENT ON BEHALF OF ATA.

SIGNATURES

ENVIRONMENTAL BRANCH MANAGER *(TYPED/PRINTED NAME)*	ENVIRONMENTAL BRANCH MANAGER *(SIGNATURE)* LEVEL I ONLY
Jim Skridulis, Ph.D.	[signature]
ENVIRONMENTAL SECTION MANAGER *(TYPED/PRINTED NAME)*	ENVIRONMENTAL SECTION MANAGER *(SIGNATURE)* LEVEL I AND II
Robert Mitchell	Bob Mitchell

SUPPORTING ATA ORGANIZATIONS

ORGANIZATION	
FA70 - Reliability Engineering Branch	
BRANCH MANAGER *(TYPED/PRINTED NAME)*	BRANCH MANAGER *(SIGNATURE)*
Ramiesh Gulati	Approved/Electronically Signed 16 March 2004 (See attached email)
ORGANIZATION	
BRANCH MANAGER *(TYPED/PRINTED NAME)*	BRANCH MANAGER *(SIGNATURE)*
ORGANIZATION	
BRANCH MANAGER *(TYPED/PRINTED NAME)*	BRANCH MANAGER *(SIGNATURE)*
ORGANIZATION	
BRANCH MANAGER *(TYPED/PRINTED NAME)*	BRANCH MANAGER *(SIGNATURE)*
ORGANIZATION	
BRANCH MANAGER *(TYPED/PRINTED NAME)*	BRANCH MANAGER *(SIGNATURE)*

Aerospace Testing Alliance
1103 Avenue B
Arnold Air Force Base Tennessee 37389-1800
931.454.3902; Fax: 931.454.7009

MEMORANDUM

Date:	26 May 2004	**Organization**	**Mail Stop**
To:	P. King	AEDC/SDE	1228
From:	R. Mitchell	SS41	1800

Subject: Toxic Release Inventory Report (Reporting Year 2003)

As required by *40 CFR Part 372.25 Toxic Chemical Release Reporting; Community Right-to-Know*, a facility must report releases and waste management activities for toxic chemicals that exceed reporting thresholds. AEDC exceeded the reporting threshold for ethylene glycol.

Please forward a cover letter and the Toxic Release Inventory (TRI) report on diskette to EPA (TRI Data Processing Center). The cover letter must include signature and official title of the senior management official listed in section 3 (vice commander) of the Form R. The cover letter should also include the following statement: *I hereby certify that I have reviewed the attached documents and that, to the best of my knowledge and belief, the submitted information is true and complete and that the amounts and values in this report are accurate based on reasonable estimates using data available to the preparers of this report.*

A separate letter and a hardcopy TRI report (signed by the vice commander) must be sent to the Tennessee Emergency Management Agency (TEMA). Refer to the attachment for the correct addresses.

Please provide a copy of these reports to Mr. D. Justice at ATA/MS 2000 and Mr. R. Mitchell at ATA/MS 1800.

Attachment:

List of Addresses

TRI Report
Reporting Year 2003
Submittal Addresses

To submit TRI diskette and cover letter:

TRI Data Processing Center
c/o Computer Sciences Corporation
Suite 300
8400 Corporate Drive
Landover, MD 20785

To submit hardcopy TRI report and letter:

Ms. Betty Eaves, Administrator
Tennessee Emergency Management Agency
3041 Sidco Drive
Nashville, TN 37204

(IMPORTANT: Type or print; read instructions before completing form)

Form Approved OMB Number:2070-0093
Approval Expires: 1/31/2006

EPA
United States Environmental Protection Agency

FORM R

Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986, also known as Title III of the Superfund Amendments and Reauthorization Act

TRI Facility ID Number: 37389RNLDN100KI

Toxic Chemical, Category or Generic Name: Ethylene glycol

WHERE TO SEND COMPLETED FORMS: 1. TRI Data Processing Center, P.O.Box 1513, Lanham, MD 20703-1513 2. APPROPRIATE STATE OFFICE (See instructions in Appendix F)

Enter "X" here if this is a revision: [ ]

For EPA use only

Important: See instructions to determine when "Not Applicable (NA)" boxes should be checked.

PART I. FACILITY IDENTIFICATION INFORMATION

SECTION 1. REPORTING YEAR 2003

SECTION 2. TRADE SECRET INFORMATION

2.1 Are you claiming the toxic chemical identified on page 2 trade secret?
[ ] Yes (Answer question 2.2; Attach substantiation forms) [X] NO (Do not answer 2.2; Go to Section 3)

2.2 Is this copy [ ] Sanitized [ ] Unsanitized (Answer only if "YES" in 2.1)

SECTION 3. CERTIFICATION (Important: Read and sign after completing all form sections.)

I hereby certify that I have reviewed the attached documents and that, to the best of my knowledge and belief, the submitted information is true and complete and that the amounts and values in this report are accurate based on reasonable estimates using data availble to the preparers of this report.

Name and official title of owner/operator or senior management official:	Signature:	Date Signed:
VINCENT L. ALBERT, Colonel, USAF VICE COMMANDER		06/15/2004

SECTION 4. FACILITY IDENTIFICATION

4.1 TRI Facility ID Number: 37389RNLDN100KI

Facility or Establishment Name	Facility or Establishment Name or Mailing Address (if different from street address)
U.S.DOD USAF ARNOLD AFB, TN	
Street: 100 KINDEL DRIVE	Mailing Address: NA
City/County/State/Zip Code: ARNOLD, AFB COFFEE TN 37389-1228	City/State/Zip Code:	Country (Non-US

4.2 This report contains information for: (Important: check a or b; check c or d if applicable)
a. [X] An entire facility b. [ ] Part of a facility c. [X] A Federal facility d. [ ] GOCO

			Telephone Number (include area code)
4.3	Technical Contact Name	CHARLES KING	(931) 454-7743
	Email Address	charles.king@arnold.af.mil	
4.4	Public Contact Name	CAPT Roger Burdette	(931) 454-4204

4.5	SIC Code (s) (4 digits)	Primary a. 9711	b.	c.	d.	e.	f.

4.6	Latitude	Degrees	Minutes	Seconds	Longitude	Degrees	Minutes	Seconds
		35	22	30		086	02	30

4.7 Dun & Bradstreet Number(s) (9 digits)	4.8 EPA Identification Number (RCRA I.D. No.) (12 characters)	4.9 Facility NPDES Permit Number(s) (9 characters)	4.10 Underground Injection Well Code (UIC) I.D. Number(s) (12 digits)
a. NA	a. TN8570024044	a. TN0003751	a. NA
b.	b.	b.	b.

SECTION 5. PARENT COMPANY INFORMATION

5.1	Name of Parent Company	NA [ ]	US Department of Defense
5.2	Parent Company's Dun & Bradstreet Number	NA [X]	

EPA FORM R
PART II. CHEMICAL - SPECIFIC INFORMATION

TRI Facility ID Number	37389RNLDN100KI
Toxic Chemical, Category or Generic Name	Ethylene glycol

SECTION 1. TOXIC CHEMICAL IDENTITY (Important: DO NOT complete this section if you completed Section 2 below.)

1.1	CAS Number (Important: Enter only one number exactly as it appears on the Section 313 list. Enter category code if reporting a chemical category.) 107-21-1
1.2	Toxic Chemical or Chemical Category Name (Important: Enter only one name exactly as it appears on the Section 313 list.) Ethylene glycol
1.3	Generic Chemical Name (Important: Complete only if Part 1, Section 2.1 is checked "Yes". Generic Name must be structurally descriptive.) NA

1.4 **Distribution of Each Member of the Dioxin and Dioxin-like Compounds Category.**
(If there are any numbers in boxes 1-17, then every field must be filled in with either 0 or some number between 0.01 and 100. Distribution should be reported in percentages and the total should equal 100%. If you do not have speciation data available, indicate NA.)

NA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
☐																	

SECTION 2. MIXTURE COMPONENT IDENTITY (Important: DO NOT complete this section if you completed Section 1 above.)

2.1	Generic Chemical Name Provided by Supplier (Important: Maximum of 70 characters, including numbers, letters, spaces, and punctuation.) NA

SECTION 3. ACTIVITIES AND USES OF THE TOXIC CHEMICAL AT THE FACILITY
(Important: Check all that apply.)

3.1 Manufacture the toxic chemical:	3.2 Process the toxic chemical:	3.3 Otherwise use the toxic chemical:
a. ☐ Produce b. ☐ Import		
If produce or import:	a. ☐ As a reactant	a. ☐ As a chemical processing aid
c. ☐ For on-site use/processing	b. ☐ As a formulation component	b. ☐ As a manufacturing aid
d. ☐ For sale/distribution	c. ☐ As an article component	c. ☒ Ancillary or other use
e. ☐ As a byproduct	d. ☐ Repackaging	
f. ☐ As an impurity	e. ☐ As an impurity	

SECTION 4. MAXIMUM AMOUNT OF THE TOXIC CHEMICAL ONSITE AT ANY TIME DURING THE CALENDAR YEAR

4.1	05	(Enter two-digit code from instruction package.)

SECTION 5. QUANTITY OF THE TOXIC CHEMICAL ENTERING EACH ENVIRONMENTAL MEDIUM ONSITE

			A. Total Release (pounds/year*) (Enter range code or estimate**)	B. Basis of Estimate (enter code)	C. % From Stormwater
5.1	Fugitive or non-point air emissions	NA ☒			
5.2	Stack or point air emissions	NA ☐	11400	O	
5.3	Discharges to receiving streams or water bodies (enter one name per box)				
	Stream or Water Body Name				
5.3.1	Rowland Creek		26500	O	0
5.3.2					
5.3.3					

If additional pages of Part II, Section 5.3 are attached, indicate the total number of pages in this box ☐
and indicate the Part II, Section 5.3 page number in this box. ☐ **(example: 1,2,3, etc.)**

* For Dioxin or Dioxin-like compounds, report in grams/year

** Range Codes: A= 1- 10 pounds; B= 11- 499 pounds; C= 500 - 999 pounds.

EPA FORM R PART II. CHEMICAL - SPECIFIC INFORMATION (CONTINUED)	TRI Facility ID Number: 37389RNLDN100KI Toxic Chemical, Category, or Generic Name: Ethylene glycol

SECTION 5. QUANTITY OF THE TOXIC CHEMICAL ENTERING EACH ENVIRONMENTAL MEDIUM ONSITE (Continued)

		NA	A. Total Release (pounds/year*) (enter range code** or estimate)	B. Basis of Estimate (enter code)
5.4.1	Underground Injection onsite to Class I Wells	X		
5.4.2	Underground Injection onsite to Class II-V Wells	X		
5.5	Disposal to land onsite			
5.5.1.A	RCRA Subtitle C landfills	X		
5.5.1.B	Other landfills	X		
5.5.2	Land treatment/application farming	X		
5.5.3A	RCRA Subtitle C Surface Impoundments	X		
5.5.3B	Other surface impoundments	X		
5.5.4	Other disposal		92	O

SECTION 6. TRANSFERS OF THE TOXIC CHEMICAL IN WASTES TO OFF-SITE LOCATIONS

6.1 DISCHARGES TO PUBLICLY OWNED TREATMENT WORKS (POTWs)

6.1.A Total Quantity Transferred to POTWs and Basis of Estimate

6.1.A.1. Total Transfers (pounds/year*) (enter range code** or estimate)	6.1.A.2 Basis of Estimate (enter code)
NA	

6.1.B. 1	POTW Name	NA					
POTW Address							
City		State		County		Zip	
6.1.B.	POTW Name						
POTW Address							
City		State		County		Zip	

If additional pages of Part II, Section 6.1 are attached, indicate the total number of pages in this box [ ] and indicate the Part II, Section 6.1 page number in this box [ ] (example: 1,2,3, etc.)

SECTION 6.2 TRANSFERS TO OTHER OFF-SITE LOCATIONS

6.2. 1	Off-Site EPA Identification Number (RCRA ID No.)	FLD980559728							
Off-Site Location Name	Perma Fix of Orlando								
Off-site Address	10100 Rocket Blvd.								
City	Orlando	State	FL	County	Orange	Zip	32824	Country (Non-US)	

Is location under control of reporting facility or parent company? [ ] Yes [X] No

* For Dioxin or Dioxin-like compounds, report in grams/year

** Range Codes: A= 1- 10 pounds; B= 11- 499 pounds; C= 500 - 999 pounds.

EPA FORM R

PART II. CHEMICAL - SPECIFIC INFORMATION (CONTINUED)

TRI Facility ID Number
37389RNLDN100KI
Toxic Chemical, Category, or Generic Name
Ethylene glycol

SECTION 6.2 TRANSFERS TO OTHER OFF-SITE LOCATIONS (Continued)

A. Total Transfers (pounds/year*) (enter range code** or estimate)	B. Basis of Estimate (enter code)	C. Type of Waste Treatment/Disposal/ Recycling/Energy Recovery (enter code)
1. 150	1. M	1. M94
2. NA	2.	2.
3.	3.	3.
4.	4.	4.

6.2. Off-Site EPA Identification Number (RCRA ID No.)

Off-Site location Name

Off-site Address

City		State		County		Zip		Country (Non-US)	

Is location under control of reporting facility or parent company? ☐ Yes ☐ No

A. Total Transfers (pounds/year*) (enter range code** or estimate)	B. Basis of Estimate (enter code)	C. Type of Waste Treatment/Disposal/ Recycling/Energy Recovery (enter code)
1.	1.	1.
2.	2.	2.
3.	3.	3.
4.	4.	4.

SECTION 7A. ONSITE WASTE TREATMENT METHODS AND EFFICIENCY

X Not Applicable (NA) - Check here if no on-site waste treatment is applied to any waste stream containing the toxic chemical or chemical category.

a. General Waste Stream (enter code)	b. Waste Treatment Method(s) Sequence [enter 3-character code(s)]	c. Range of Influent Concentration	d. Waste Treatment Efficiency Estimate	e. Based on Operating Data ?
7A.1a	7A.1b 1 ___ 2 ___ 3 ___ 4 ___ 5 ___ 6 ___ 7 ___ 8 ___	7A.1c	7A.1d %	7A.1e Yes ☐ No ☐
7A.2a	7A.2b 1 ___ 2 ___ 3 ___ 4 ___ 5 ___ 6 ___ 7 ___ 8 ___	7A.2c	7A.2d %	7A.2e Yes ☐ No ☐
7A.3a	7A.3b 1 ___ 2 ___ 3 ___ 4 ___ 5 ___ 6 ___ 7 ___ 8 ___	7A.3c	7A.3d %	7A.3e Yes ☐ No ☐
7A.4a	7A.4b 1 ___ 2 ___ 3 ___ 4 ___ 5 ___ 6 ___ 7 ___ 8 ___	7A.4c	7A.4d %	7A.4e Yes ☐ No ☐
7A.5a	7A.5b 1 ___ 2 ___ 3 ___ 4 ___ 5 ___ 6 ___ 7 ___ 8 ___	7A.5c	7A.5d %	7A.5e Yes ☐ No ☐

If additional pages of Part II, Section 6.2/7A are attached, indicate the total number of pages in this box ☐
and indicate the Part II, Section 6.2/7A page number in this box: ☐ **(example: 1,2,3, etc.)**

* For Dioxin or Dioxin-like compounds, report in grams/year

** Range Codes: A= 1- 10 pounds; B= 11- 499 pounds; C= 500 - 999 pounds.

EPA FORM R
PART II. CHEMICAL-SPECIFIC INFORMATION (CONTINUED)

TRI Facility ID Number: 37389RNLDN100KI
Toxic Chemical, Category, or Generic Name: Ethylene glycol

SECTION 7B. ON-SITE ENERGY RECOVERY PROCESSES

[X] Not Applicable (NA) - Check here if no on-site energy recovery is applied to any waste stream containing the toxic chemical or chemical category.

Energy Recovery Methods [enter 3-character code(s)]

1 ____ 2 ____ 3 ____

SECTION 7C. ON-SITE RECYCLING PROCESSES

[X] Not Applicable (NA) - Check here if no on-site recyling is applied to any waste stream containing the toxic chemical or chemical category.

Recycling Methods [enter 3-character code(s)]

1 ____ 2 ____ 3 ____ 4 ____ 5 ____
6 ____ 7 ____ 8 ____ 9 ____ 10 ____

SECTION 8. SOURCE REDUCTION AND RECYCLING ACTIVITIES

		Column A Prior Year (pounds/year*)	Column B Current Reporting Year (pounds/year*)	Column C Following Year (pounds/year*)	Column D Second Following Year (pounds/year*)
8.1					
8.1a	Total on-site disposal to Class I Underground Injection Wells, RCRA Subtitle C landfills, and other landfills	NA	NA	NA	NA
8.1b	Total other on-site disposal or other releases	53300	38000	38000	38000
8.1c	Total off-site disposal to Class I Underground Injection Wells, RCRA Subtitle C landfills, and other landfills	NA	NA	NA	NA
8.1d	Total other off-site disposal or other releases	NA	150	100	100
8.2	Quantity used for energy recovery onsite	NA	NA	NA	NA
8.3	Quantity used for energy recovery offsite	NA	NA	NA	NA
8.4	Quantity recycled onsite	NA	NA	NA	NA
8.5	Quantity recycled offsite	NA	NA	NA	NA
8.6	Quantity treated onsite	NA	NA	NA	NA
8.7	Quantity treated offsite	850	NA	NA	NA
8.8	Quantity released to the environment as a result of remedial actions, catastrophic events, or one-time events not associated with productionprocesses (pounds/year)	NA			
8.9	Production ratio or activity index	1.00			

8.10 Did your facility engage in any source reduction activities for this chemical during the reporting year? If not, enter "NA" in Section 8.10.1 and answer Section 8.11.

	Source Reduction Activities [enter code(s)]	Methods to Identify Activity (enter codes)		
8.10.1	NA	a.	b.	c.
8.10.2		a.	b.	c.
8.10.3		a.	b.	c.
8.10.4		a.	b.	c.

8.11 Is additional information on source reduction, recycling, or pollution control activities included with this report ? (Check one Box) Yes [ ] No [X]

Toxic Release Inventory Report
CY 2004

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS ARNOLD ENGINEERING DEVELOPMENT CENTER (AFMC)
ARNOLD AIR FORCE BASE TENNESSEE

7 June 2005

AEDC/SDE
100 Kindel Drive, Suite A228
Arnold AFB TN 37389-1228

Ms. Betty Eaves, Administrator
Tennessee Emergency Response Council
c/o Tennessee Emergency Management Agency (TEMA)
3041 Sidco Drive
Nashville, TN 37204-1502

Dear Ms. Eaves

Enclosed please find one (1) Toxic Release Inventory report containing toxic chemical release reporting information for Arnold Engineering Development Center (AEDC). This information is submitted as required under Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 and Pollution Prevention Act of 1990. A total of two (2) reports are included from our facility, concerning the following chemicals:

Chemical Name	RY	CAS Number
Ethylene Glycol	2004	107-21-1
Dichlorodifluoromethane	2004	75-71-8

If you have any questions, please contact Ms. Pam King at (931)454-7609.

Sincerely

CHARLES H. KING
Acting Deputy Director
Mission Support Directorate

2 Attachments:
1. Form R Package (Ethylene Glycol)
2. Form R Package (Dichlorodifluoromethane)

cc:
ATA (Ms. L. McEntee)
SDE (Ms. P. King)

EPA
United States Environmental Protection Agency

FORM R

Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986, also known as Title III of the Superfund Amendments and Reauthorization Act

TRI Facility ID Number: 37389RNLDN100KI
Toxic Chemical, Category or Generic Name: Ethylene glycol

WHERE TO SEND COMPLETED FORMS: 1. TRI Data Processing Center, P.O.Box 1513, Lanham, MD 20703-1513 2. APPROPRIATE STATE OFFICE (See instructions in Appendix F)

Enter "X" here if this is a revision

For EPA use only

Important: See instructions to determine when "Not Applicable (NA)" boxes should be checked.

PART I. FACILITY IDENTIFICATION INFORMATION

SECTION 1. REPORTING YEAR 2004

SECTION 2. TRADE SECRET INFORMATION

2.1 Are you claiming the toxic chemical identified on page 2 trade secret?
[ ] Yes (Answer question 2.2; Attach substantiation forms) [X] NO (Do not answer 2.2; Go to Section 3)

2.2 Is this copy [ ] Sanitized [ ] Unsanitized (Answer only if "YES" in 2.1)

SECTION 3. CERTIFICATION (Important: Read and sign after completing all form sections.)

I hereby certify that I have reviewed the attached documents and that, to the best of my knowledge and belief, the submitted information is true and complete and that the amounts and values in this report are accurate based on reasonable estimates using data available to the preparers of this report.

Name and official title of owner/operator or senior management official:	Signature:	Date Signed:
CHARLES H. KING Actg Deputy Director	[signature]	[illegible]

SECTION 4. FACILITY IDENTIFICATION

4.1 TRI Facility ID Number: 37389RNLDN100KI

Facility or Establishment Name	Facility or Establishment Name or Mailing Address (if different from street address)
U.S. DOD USAF ARNOLD AFB TN	
Street: 100 KINDEL DRIVE	Mailing Address: NA
City/County/State/Zip Code: ARNOLD AFB COFFEE TN 37389-1228	City/State/Zip Code:	Country (Non-US)

4.2 This report contains information for: (Important: check a or b; check c or d if applicable)
a. [X] An entire facility b. [ ] Part of a facility c. [X] A Federal facility d. [ ] GOCO

4.3	Technical Contact Name	CHARLES KING	Telephone Number (include area code): (931) 454-7743
	Email Address	charles.king@arnold.af.mil	
4.4	Public Contact Name	CAPT Roger Burdette	Telephone Number (include area code): (931) 454-4204

4.5	SIC Code (s) (4 digits)	Primary a.	b.	c.	d.	e.	f.
		9711					

4.6	Latitude Degrees	Minutes	Seconds	Longitude Degrees	Minutes	Seconds
	35	22	30	086	02	30

4.7 Dun & Bradstreet Number(s) (9 digits)	4.8 EPA Identification Number (RCRA I.D. No.) (12 characters)	4.9 Facility NPDES Permit Number(s) (9 characters)	4.10 Underground Injection Well Code (UIC) I.D. Number(s) (12 digits)
a. NA	a. TN8570024044	a. TN0003751	a. NA
b.	b.	b.	b.

SECTION 5. PARENT COMPANY INFORMATION

5.1	Name of Parent Company	NA [ ]	US Department of Defense
5.2	Parent Company's Dun & Bradstreet Number	NA [X]	

EPA FORM R
PART II. CHEMICAL - SPECIFIC INFORMATION

TRI Facility ID Number
37389RNLDN100KI
Toxic Chemical, Category or Generic Name
Ethylene glycol

SECTION 1. TOXIC CHEMICAL IDENTITY

(Important: DO NOT complete this section if you completed Section 2 below.)

1.1	CAS Number (Important: Enter only one number exactly as it appears on the Section 313 list. Enter category code if reporting a chemical category.) 107-21-1
1.2	Toxic Chemical or Chemical Category Name (Important: Enter only one name exactly as it appears on the Section 313 list.) Ethylene glycol
1.3	Generic Chemical Name (Important: Complete only if Part 1, Section 2.1 is checked "Yes". Generic Name must be structurally descriptive.) NA

1.4 Distribution of Each Member of the Dioxin and Dioxin-like Compounds Category.
(If there are any numbers in boxes 1-17, then every field must be filled in with either 0 or some number between 0.01 and 100. Distribution should be reported in percentages and the total should equal 100%. If you do not have speciation data available, indicate NA.)

NA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

SECTION 2. MIXTURE COMPONENT IDENTITY

(Important: DO NOT complete this section if you completed Section 1 above.)

2.1	Generic Chemical Name Provided by Supplier (Important: Maximum of 70 characters, including numbers, letters, spaces, and punctuation.) NA

SECTION 3. ACTIVITIES AND USES OF THE TOXIC CHEMICAL AT THE FACILITY

(Important: Check all that apply.)

3.1 Manufacture the toxic chemical:
- a. [ ] Produce b. [ ] Import
- If produce or import:
- c. [ ] For on-site use/processing
- d. [ ] For sale/distribution
- e. [ ] As a byproduct
- f. [ ] As an impurity

3.2 Process the toxic chemical:
- a. [ ] As a reactant
- b. [ ] As a formulation component
- c. [ ] As an article component
- d. [ ] Repackaging
- e. [ ] As an impurity

3.3 Otherwise use the toxic chemical:
- a. [ ] As a chemical processing aid
- b. [ ] As a manufacturing aid
- c. [X] Ancillary or other use

SECTION 4. MAXIMUM AMOUNT OF THE TOXIC CHEMICAL ONSITE AT ANY TIME DURING THE CALENDAR YEAR

4.1 05 (Enter two-digit code from instruction package.)

SECTION 5. QUANTITY OF THE TOXIC CHEMICAL ENTERING EACH ENVIRONMENTAL MEDIUM ONSITE

			A. Total Release (pounds/year*) (Enter range code or estimate**)	B. Basis of Estimate (enter code)	C. % From Stormwater
5.1	Fugitive or non-point air emissions	NA X			
5.2	Stack or point air emissions	NA	8361	O	
5.3	Discharges to receiving streams or water bodies (enter one name per box)				
	Stream or Water Body Name				
5.3.1	Rowland Creek		55956	O	0
5.3.2					
5.3.3					

If additional pages of Part II, Section 5.3 are attached, indicate the total number of pages in this box [ ]
and indicate the Part II, Section 5.3 page number in this box. [ ] **(example: 1,2,3, etc.)**

* For Dioxin or Dioxin-like compounds, report in grams/year

** Range Codes: A= 1- 10 pounds; B= 11- 499 pounds; C= 500 - 999 pounds.

EPA FORM R

PART II. CHEMICAL - SPECIFIC INFORMATION (CONTINUED)

TRI Facility ID Number	37389RNLDN100KI
Toxic Chemical, Category, or Generic Name	Ethylene glycol

SECTION 5. QUANTITY OF THE TOXIC CHEMICAL ENTERING EACH ENVIRONMENTAL MEDIUM ONSITE (Continued)

		NA	A. Total Release (pounds/year*) (enter range code** or estimate)	B. Basis of Estimate (enter code)
5.4.1	Underground Injection onsite to Class I Wells	X		
5.4.2	Underground Injection onsite to Class II-V Wells	X		
5.5	Disposal to land onsite			
5.5.1.A	RCRA Subtitle C landfills	X		
5.5.1.B	Other landfills	X		
5.5.2	Land treatment/application farming	X		
5.5.3A	RCRA Subtitle C Surface Impoundments	X		
5.5.3B	Other surface impoundments	X		
5.5.4	Other disposal		113	O

SECTION 6. TRANSFERS OF THE TOXIC CHEMICAL IN WASTES TO OFF-SITE LOCATIONS

6.1 DISCHARGES TO PUBLICLY OWNED TREATMENT WORKS (POTWs)

6.1.A Total Quantity Transferred to POTWs and Basis of Estimate

6.1.A.1. Total Transfers (pounds/year*) (enter range code** or estimate)	6.1.A.2 Basis of Estimate (enter code)
NA	

6.1.B. 1	POTW Name	NA					
POTW Address							
City		State		County		Zip	
6.1.B.	POTW Name						
POTW Address							
City		State		County		Zip	

If additional pages of Part II, Section 6.1 are attached, indicate the total number of pages in this box [ ] and indicate the Part II, Section 6.1 page number in this box [ ] (example: 1,2,3, etc.)

SECTION 6.2 TRANSFERS TO OTHER OFF-SITE LOCATIONS

6.2. 1	Off-Site EPA Identification Number (RCRA ID No.)	FLD980559728							
Off-Site Location Name	Perma Fix of Orlando								
Off-site Address	10100 Rocket Blvd.								
City	Orlando	State	FL	County	Orange	Zip	32824	Country (Non-US)	

Is location under control of reporting facility or parent company? [ ] Yes [X] No

* For Dioxin or Dioxin-like compounds, report in grams/year

** Range Codes: A= 1- 10 pounds; B= 11- 499 pounds; C= 500 - 999 pounds.

EPA FORM R
PART II. CHEMICAL - SPECIFIC INFORMATION (CONTINUED)

TRI Facility ID Number
37389RNLDN100KI
Toxic Chemical, Category, or Generic Name
Ethylene glycol

SECTION 6.2 TRANSFERS TO OTHER OFF-SITE LOCATIONS (Continued)

A. Total Transfers (pounds/year*) (enter range code** or estimate)	B. Basis of Estimate (enter code)	C. Type of Waste Treatment/Disposal/ Recycling/Energy Recovery (enter code)
1. 456	1. M	1. M20
2. 116	2. M	2. M40
3. NA	3.	3.
4.	4.	4.

6.2. Off-Site EPA Identification Number (RCRA ID No.)	
Off-Site location Name	
Off-site Address	

City		State		County		Zip		Country (Non-US)	

Is location under control of reporting facility or parent company? ☐ Yes ☐ No

A. Total Transfers (pounds/year*) (enter range code** or estimate)	B. Basis of Estimate (enter code)	C. Type of Waste Treatment/Disposal/ Recycling/Energy Recovery (enter code)
1.	1.	1.
2.	2.	2.
3.	3.	3.
4.	4.	4.

SECTION 7A. ONSITE WASTE TREATMENT METHODS AND EFFICIENCY

[X] Not Applicable (NA) - Check here if no on-site waste treatment is applied to any waste stream containing the toxic chemical or chemical category.

a. General Waste Stream (enter code)	b. Waste Treatment Method(s) Sequence [enter 3-character code(s)]	c. Range of Influent Concentration	d. Waste Treatment Efficiency Estimate	e. Based on Operating Data ?
7A.1a	7A.1b 1 2 3 4 5 6 7 8	7A.1c	7A.1d %	7A.1e Yes No
7A.2a	7A.2b 1 2 3 4 5 6 7 8	7A.2c	7A.2d %	7A.2e Yes No
7A.3a	7A.3b 1 2 3 4 5 6 7 8	7A.3c	7A.3d %	7A.3e Yes No
7A.4a	7A.4b 1 2 3 4 5 6 7 8	7A.4c	7A.4d %	7A.4e Yes No
7A.5a	7A.5b 1 2 3 4 5 6 7 8	7A.5c	7A.5d %	7A.5e Yes No

If additional pages of Part II, Section 6.2/7A are attached, indicate the total number of pages in this box ☐
and indicate the Part II, Section 6.2/7A page number in this box: ☐ **(example: 1,2,3, etc.)**

* For Dioxin or Dioxin-like compounds, report in grams/year

** Range Codes: A= 1- 10 pounds; B= 11- 499 pounds; C= 500 - 999 pounds.

EPA FORM R PART II. CHEMICAL-SPECIFIC INFORMATION (CONTINUED)	TRI Facility ID Number: 37389RNLDN100KI Toxic Chemical, Category, or Generic Name: Ethylene glycol

SECTION 7B. ON-SITE ENERGY RECOVERY PROCESSES

[X] Not Applicable (NA) - Check here if no on-site energy recovery is applied to any waste stream containing the toxic chemical or chemical category.

Energy Recovery Methods [enter 3-character code(s)]

1 ____ 2 ____ 3 ____

SECTION 7C. ON-SITE RECYCLING PROCESSES

[X] Not Applicable (NA) - Check here if no on-site recyling is applied to any waste stream containing the toxic chemical or chemical category.

Recycling Methods [enter 3-character code(s)]

1 ____ 2 ____ 3 ____ 4 ____ 5 ____
6 ____ 7 ____ 8 ____ 9 ____ 10 ____

SECTION 8. SOURCE REDUCTION AND RECYCLING ACTIVITIES

		Column A Prior Year (pounds/year*)	Column B Current Reporting Year (pounds/year*)	Column C Following Year (pounds/year*)	Column D Second Following Year (pounds/year*)
8.1					
8.1a	Total on-site disposal to Class I Underground Injection Wells, RCRA Subtitle C landfills, and other landfills	NA	NA	NA	NA
8.1b	Total other on-site disposal or other releases	37992	64430	64000	64000
8.1c	Total off-site disposal to Class I Underground Injection Wells, RCRA Subtitle C landfills, and other landfills	NA	NA	NA	NA
8.1d	Total other off-site disposal or other releases	150	NA	NA	NA
8.2	Quantity used for energy recovery onsite	NA	NA	NA	NA
8.3	Quantity used for energy recovery offsite	NA	NA	NA	NA
8.4	Quantity recycled onsite	NA	NA	NA	NA
8.5	Quantity recycled offsite	NA	456	400	400
8.6	Quantity treated onsite	NA	NA	NA	NA
8.7	Quantity treated offsite	NA	116	100	100

8.8	Quantity released to the environment as a result of remedial actions, catastrophic events, or one-time events not associated with production processes (pounds/year)	NA
8.9	Production ratio or activity index	1.00

8.10 Did your facility engage in any source reduction activities for this chemical during the reporting year? If not, enter "NA" in Section 8.10.1 and answer Section 8.11.

	Source Reduction Activities [enter code(s)]	Methods to Identify Activity (enter codes)		
8.10.1	NA	a.	b.	c.
8.10.2		a.	b.	c.
8.10.3		a.	b.	c.
8.10.4		a.	b.	c.

8.11 Is additional information on source reduction, recycling, or pollution control activities included with this report ? (Check one Box) Yes [ ] No [X]

*For Dioxin or Dioxin-like compounds, report in grams/year

EPA
United States Environmental Protection Agency

FORM R

Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986, also known as Title III of the Superfund Amendments and Reauthorization Act

TRI Facility ID Number: 37389RNLDN100KI

Toxic Chemical, Category or Generic Name: Dichlorodifluoromethane (CFC-12)

WHERE TO SEND COMPLETED FORMS: 1. TRI Data Processing Center, P.O.Box 1513, Lanham, MD 20703-1513 2. APPROPRIATE STATE OFFICE (See instructions in Appendix F)

Enter "X" here if this is a revision:

For EPA use only

Important: See instructions to determine when "Not Applicable (NA)" boxes should be checked.

PART I. FACILITY IDENTIFICATION INFORMATION

SECTION 1. REPORTING YEAR 2004

SECTION 2. TRADE SECRET INFORMATION

2.1 Are you claiming the toxic chemical identified on page 2 trade secret?
[ ] Yes (Answer question 2.2; Attach substantiation forms) [X] NO (Do not answer 2.2; Go to Section 3)

2.2 Is this copy [ ] Sanitized [ ] Unsanitized (Answer only if "YES" in 2.1)

SECTION 3. CERTIFICATION (Important: Read and sign after completing all form sections.)

I hereby certify that I have reviewed the attached documents and that, to the best of my knowledge and belief, the submitted information is true and complete and that the amounts and values in this report are accurate based on reasonable estimates using data available to the preparers of this report.

Name and official title of owner/operator or senior management official:	Signature:	Date Signed:
CHARLES H. KING, Actg. Deputy Director		6 Jun 05

SECTION 4. FACILITY IDENTIFICATION

4.1 TRI Facility ID Number: 37389RNLDN100KI

Facility or Establishment Name: U.S. DOD USAF ARNOLD AFB TN	Facility or Establishment Name or Mailing Address (if different from street address):
Street: 100 KINDEL DRIVE	Mailing Address: NA
City/County/State/Zip Code: ARNOLD AFB COFFEE TN 37389-1228	City/State/Zip Code: / Country (Non-US):

4.2 This report contains information for: (Important: check a or b; check c or d if applicable)
a. [X] An entire facility b. [ ] Part of a facility c. [X] A Federal facility d. [ ] GOCO

4.3	Technical Contact Name	CHARLES KING	Telephone Number (include area code): (931) 454-7743
	Email Address	charles.king@arnold.af.mil	
4.4	Public Contact Name	CAPT Roger Burdette	Telephone Number (include area code): (931) 454-4204

4.5 SIC Code (s) (4 digits)

Primary a.	b.	c.	d.	e.	f.
9711					

4.6

	Degrees	Minutes	Seconds
Latitude	35	22	30
Longitude	086	02	30

4.7 Dun & Bradstreet Number(s) (9 digits)	4.8 EPA Identification Number (RCRA I.D. No.) (12 characters)	4.9 Facility NPDES Permit Number(s) (9 characters)	4.10 Underground Injection Well Code (UIC) I.D. Number(s) (12 digits)
a. NA	a. TN8570024044	a. TN0003751	a. NA
b.	b.	b.	b.

SECTION 5. PARENT COMPANY INFORMATION

5.1	Name of Parent Company	NA [ ]	US Department of Defense
5.2	Parent Company's Dun & Bradstreet Number	NA [X]	

EPA FORM R
PART II. CHEMICAL - SPECIFIC INFORMATION

TRI Facility ID Number	37389RNLDN100KI
Toxic Chemical, Category or Generic Name	Dichlorodifluoromethane (CFC-12)

SECTION 1. TOXIC CHEMICAL IDENTITY (Important: DO NOT complete this section if you completed Section 2 below.)

1.1	CAS Number (Important: Enter only one number exactly as it appears on the Section 313 list. Enter category code if reporting a chemical category.) 75-71-8
1.2	Toxic Chemical or Chemical Category Name (Important: Enter only one name exactly as it appears on the Section 313 list.) Dichlorodifluoromethane (CFC-12)
1.3	Generic Chemical Name (Important: Complete only if Part 1, Section 2.1 is checked "Yes". Generic Name must be structurally descriptive.) NA

1.4 Distribution of Each Member of the Dioxin and Dioxin-like Compounds Category.
(If there are any numbers in boxes 1-17, then every field must be filled in with either 0 or some number between 0.01 and 100. Distribution should be reported in percentages and the total should equal 100%. If you do not have speciation data available, indicate NA.)

NA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

SECTION 2. MIXTURE COMPONENT IDENTITY (Important: DO NOT complete this section if you completed Section 1 above.)

2.1	Generic Chemical Name Provided by Supplier (Important: Maximum of 70 characters, including numbers, letters, spaces, and punctuation.) NA

SECTION 3. ACTIVITIES AND USES OF THE TOXIC CHEMICAL AT THE FACILITY
(Important: Check all that apply.)

3.1 Manufacture the toxic chemical:	3.2 Process the toxic chemical:	3.3 Otherwise use the toxic chemical:
a. [ ] Produce b. [ ] Import		
If produce or import:	a. [ ] As a reactant	a. [ ] As a chemical processing aid
c. [ ] For on-site use/processing	b. [ ] As a formulation component	b. [ ] As a manufacturing aid
d. [ ] For sale/distribution	c. [ ] As an article component	c. [X] Ancillary or other use
e. [ ] As a byproduct	d. [ ] Repackaging	
f. [ ] As an impurity	e. [ ] As an impurity	

SECTION 4. MAXIMUM AMOUNT OF THE TOXIC CHEMICAL ONSITE AT ANY TIME DURING THE CALENDAR YEAR

4.1 05 (Enter two-digit code from instruction package.)

SECTION 5. QUANTITY OF THE TOXIC CHEMICAL ENTERING EACH ENVIRONMENTAL MEDIUM ONSITE

			A. Total Release (pounds/year*) (Enter range code or estimate**)	B. Basis of Estimate (enter code)	C. % From Stormwater
5.1	Fugitive or non-point air emissions	NA [ ]	19900	O	
5.2	Stack or point air emissions	NA [X]			
5.3	Discharges to receiving streams or water bodies (enter one name per box)				
	Stream or Water Body Name				
5.3.1	NA				
5.3.2					
5.3.3					

If additional pages of Part II, Section 5.3 are attached, indicate the total number of pages in this box [ ]
and indicate the Part II, Section 5.3 page number in this box. [ ] **(example: 1,2,3, etc.)**

* For Dioxin or Dioxin-like compounds, report in grams/year

** Range Codes: A= 1- 10 pounds; B= 11- 499 pounds; C= 500 - 999 pounds.

EPA FORM R

PART II. CHEMICAL - SPECIFIC INFORMATION (CONTINUED)

TRI Facility ID Number	37389RNLDN100KI
Toxic Chemical, Category, or Generic Name	Dichlorodifluoromethane (CFC-12)

SECTION 5. QUANTITY OF THE TOXIC CHEMICAL ENTERING EACH ENVIRONMENTAL MEDIUM ONSITE (Continued)

		NA	A. Total Release (pounds/year*) (enter range code** or estimate)	B. Basis of Estimate (enter code)
5.4.1	Underground Injection onsite to Class I Wells	X		
5.4.2	Underground Injection onsite to Class II-V Wells	X		
5.5	Disposal to land onsite			
5.5.1.A	RCRA Subtitle C landfills	X		
5.5.1.B	Other landfills	X		
5.5.2	Land treatment/application farming	X		
5.5.3A	RCRA Subtitle C Surface Impoundments	X		
5.5.3B	Other surface impoundments	X		
5.5.4	Other disposal	X		

SECTION 6. TRANSFERS OF THE TOXIC CHEMICAL IN WASTES TO OFF-SITE LOCATIONS

6.1 DISCHARGES TO PUBLICLY OWNED TREATMENT WORKS (POTWs)

6.1.A Total Quantity Transferred to POTWs and Basis of Estimate

6.1.A.1. Total Transfers (pounds/year*) (enter range code** or estimate)	6.1.A.2 Basis of Estimate (enter code)
NA	

6.1.B. 1	POTW Name	NA					
POTW Address							
City		State		County		Zip	
6.1.B.	POTW Name						
POTW Address							
City		State		County		Zip	

If additional pages of Part II, Section 6.1 are attached, indicate the total number of pages in this box [ ] and indicate the Part II, Section 6.1 page number in this box [ ] (example: 1,2,3, etc.)

SECTION 6.2 TRANSFERS TO OTHER OFF-SITE LOCATIONS

6.2. 1 Off-Site EPA Identification Number (RCRA ID No.)	NA								
Off-Site Location Name	NA								
Off-site Address									
City		State		County		Zip		Country (Non-US)	

Is location under control of reporting facility or parent company? [ ] Yes [ ] No

* For Dioxin or Dioxin-like compounds, report in grams/year

** Range Codes: A= 1- 10 pounds; B= 11- 499 pounds; C= 500 - 999 pounds.

EPA FORM R
PART II. CHEMICAL - SPECIFIC INFORMATION (CONTINUED)

TRI Facility ID Number
37389RNLDN100KI
Toxic Chemical, Category, or Generic Name
Dichlorodifluoromethane (CFC-12)

SECTION 6.2 TRANSFERS TO OTHER OFF-SITE LOCATIONS (Continued)

A. Total Transfers (pounds/year*) (enter range code** or estimate)	B. Basis of Estimate (enter code)	C. Type of Waste Treatment/Disposal/ Recycling/Energy Recovery (enter code)
1.	1.	1.
2.	2.	2.
3.	3.	3.
4.	4.	4.

6.2. Off-Site EPA Identification Number (RCRA ID No.)	
Off-Site location Name	
Off-site Address	

City		State		County		Zip		Country (Non-US)	

Is location under control of reporting facility or parent company? ☐ Yes ☐ No

A. Total Transfers (pounds/year*) (enter range code** or estimate)	B. Basis of Estimate (enter code)	C. Type of Waste Treatment/Disposal/ Recycling/Energy Recovery (enter code)
1.	1.	1.
2.	2.	2.
3.	3.	3.
4.	4.	4.

SECTION 7A. ONSITE WASTE TREATMENT METHODS AND EFFICIENCY

[X] Not Applicable (NA) - Check here if no on-site waste treatment is applied to any waste stream containing the toxic chemical or chemical category.

a. General Waste Stream (enter code)	b. Waste Treatment Method(s) Sequence [enter 3-character code(s)]	c. Range of Influent Concentration	d. Waste Treatment Efficiency Estimate	e. Based on Operating Data ?
7A.1a	7A.1b 1 2 3 4 5 6 7 8	7A.1c	7A.1d %	7A.1e Yes ☐ No ☐
7A.2a	7A.2b 1 2 3 4 5 6 7 8	7A.2c	7A.2d %	7A.2e Yes ☐ No ☐
7A.3a	7A.3b 1 2 3 4 5 6 7 8	7A.3c	7A.3d %	7A.3e Yes ☐ No ☐
7A.4a	7A.4b 1 2 3 4 5 6 7 8	7A.4c	7A.4d %	7A.4e Yes ☐ No ☐
7A.5a	7A.5b 1 2 3 4 5 6 7 8	7A.5c	7A.5d %	7A.5e Yes ☐ No ☐

If additional pages of Part II, Section 6.2/7A are attached, indicate the total number of pages in this box ☐
and indicate the Part II, Section 6.2/7A page number in this box: ☐ (example: 1,2,3, etc.)

* For Dioxin or Dioxin-like compounds, report in grams/year

** Range Codes: A= 1- 10 pounds; B= 11- 499 pounds; C= 500 - 999 pounds.

EPA FORM R
PART II. CHEMICAL-SPECIFIC INFORMATION (CONTINUED)

TRI Facility ID Number
37389RNLDN100KI
Toxic Chemical, Category, or Generic Name
Dichlorodifluoromethane (CFC-12)

SECTION 7B. ON-SITE ENERGY RECOVERY PROCESSES

[X] Not Applicable (NA) - Check here if no on-site energy recovery is applied to any waste stream containing the toxic chemical or chemical category.

Energy Recovery Methods [enter 3-character code(s)]

1		2		3	

SECTION 7C. ON-SITE RECYCLING PROCESSES

[ ] Not Applicable (NA) - Check here if no on-site recyling is applied to any waste stream containing the toxic chemical or chemical category.

Recycling Methods [enter 3-character code(s)]

1	R99	2		3		4		5	
6		7		8		9		10	

SECTION 8. SOURCE REDUCTION AND RECYCLING ACTIVITIES

		Column A Prior Year (pounds/year*)	Column B Current Reporting Year (pounds/year*)	Column C Following Year (pounds/year*)	Column D Second Following Year (pounds/year*)
8.1					
8.1a	Total on-site disposal to Class I Underground Injection Wells, RCRA Subtitle C landfills, and other landfills	NA	NA	NA	NA
8.1b	Total other on-site disposal or other releases	NA	7154	7000	7000
8.1c	Total off-site disposal to Class I Underground Injection Wells, RCRA Subtitle C landfills, and other landfills	NA	NA	NA	NA
8.1d	Total other off-site disposal or other releases	NA	NA	NA	NA
8.2	Quantity used for energy recovery onsite	NA	NA	NA	NA
8.3	Quantity used for energy recovery offsite	NA	NA	NA	NA
8.4	Quantity recycled onsite	NA	0	0	0
8.5	Quantity recycled offsite	NA	NA	NA	NA
8.6	Quantity treated onsite	NA	NA	NA	NA
8.7	Quantity treated offsite	NA	NA	NA	NA

8.8	Quantity released to the environment as a result of remedial actions, catastrophic events, or one-time events not associated with production processes (pounds/year)	12746
8.9	Production ratio or activity index	1.00

8.10 Did your facility engage in any source reduction activities for this chemical during the reporting year? If not, enter "NA" in Section 8.10.1 and answer Section 8.11.

	Source Reduction Activities [enter code(s)]	Methods to Identify Activity (enter codes)		
8.10.1	W13	a. T11	b.	c.
8.10.2	NA	a.	b.	c.
8.10.3		a.	b.	c.
8.10.4		a.	b.	c.

		Yes	No
8.11	Is additional information on source reduction, recycling, or pollution control activities included with this report ? (Check one Box)	[ ]	[X]

*For Dioxin or Dioxin-like compounds, report in grams/year

APPENDIX J

Utility Usage
FY 2000 - 2005

Table J-1: Utility Usage FY 2000 - 2005

Fiscal Year	TVA Power TOTAL KWHs BILLED	Peak KWs Power	Raw H2O KGALs USED	NAT GAS MCF Billed	Potable Water H2O GALs	Waste Water Treated H2O Gals	Steam Produced SP "A" Klb
2000	445,952,875	2,846,434	37,331,372	644,248	229,486,659	15,638,310	497,915
2001	385,644,864	2,617,728	28,788,657	640,564	249,307,175	7,615,577	537,994
2002	344,198,976	2,990,400	24,493,535	605,364	270,081,307	15,398,754	476,954
2003	339,903,183	2,816,944	27,154,508	560,749	252,539,909	5,974,906	449,408
2004	390,359,136	3,539,136	29,875,301	589,212	237,402,134	7,239,017	439,579
2005	372,734,496	3,236,928	27,477,306	583,218	286,709,510	7,624,170	430,331
Average	379,798,922		29,186,780	603,892	254,254,449	9,915,122	472,030
Min	339,903,183		24,493,535	560,749	229,486,659	5,974,906	430,331
Max	445,952,875		37,331,372	644,248	286,709,510	15,638,310	537,994

Raw Water

	Primary Pumping Station Kgal	Sec Pump Sta & Rowland Crk Pump Sta Kgal	CTowers, Base gallons Kgal	Sum Kgal	Report Sum Kgal	Total Base Flow, Gallons Kgal	Total Freeze Protection Kgal	Total Test Flow, gallons Kgal	Total Kgals Kgal
2000	10,709,877	20,215,856	17,115,516	37,462,033	48,041,248	6,741,678	2,034,148	28,389,905	#########
2001	6,535,412	25,052,489	3,736,168	29,711,197	35,324,069	5,476,319	3,644,135	20,024,823	#########
2002	6,687,988	13,534,146	10,959,389	24,493,535	31,181,523	6,693,895	1,888,047	15,850,309	#########
2003	6,254,944	16,190,330	10,964,178	27,091,751	33,409,452	6,536,943	1,887,168	17,402,433	#########
2004	8,590,705	17,055,111	12,820,190	38,466,006	38,466,006	6,522,078	2,006,301	21,318,558	#########
2005	10,475,901	15,142,409	12,334,897	37,953,207	37,953,207	6,662,931	533,400	21,327,991	#########
Average	8,209,138	17,865,057	11,321,723	32,529,621	37,395,917	6,438,974	1,998,867	20,719,003	#########
Min	6,254,944	13,534,146	3,736,168	24,493,535	31,181,523	5,476,319	533,400	15,850,309	#########
Max	10,709,877	25,052,489	17,115,516	38,466,006	48,041,248	6,741,678	3,644,135	28,389,905	#########

Table J-1: (continued)

Steam Plant Production and Usage

Fiscal Year	Total steam produced (pounds)	Average test load	Average base load	ETF	VKF	PWT	Steam Plant A produced	Steam Plant C produced
2000	497,915,000	1,177,852	2,163,542	37,061,000	5,367,180	-	486,835,000	12,433,000
2001	537,994,000	88,723	127,445,067	24,463,000	36,217,000	-	529,348,000	8,646,000
2002	476,954,000	95,225	4,634,420	20,022,000	2,676,000	202,000	470,408,000	8,126,000
2003	449,408,000	88,635	570,586	20,799,000	4,488,000	40,000	439,088,000	10,320,000
2004	439,579,000	105,025	54,147,054	26,070,218	4,312,000	-	435,633,000	3,946,000
2005	430,331,000	90,834	403,110	27,221,000	5,553,000	316,000	430,331,000	356,000
Average	472,030,167	274,382	31,560,630	25,939,370	9,768,863	93,000	465,273,833	7,304,500
Min	430,331,000	88,635	403,110	20,022,000	2,676,000	-	430,331,000	356,000
Max	537,994,000	1,177,852	127,445,067	37,061,000	36,217,000	316,000	529,348,000	12,433,000

Steam Plant Production and Usage

Fiscal Year	Steam Plant A Electrical Usage (kWh)	Steam Plant A Natural Gas Usage (MSCF)	Steam Plant A Fuel Oil Usage (GAL)	Steam Plant A Makeup Water Usage (GAL)	Steam Plant A Return Condensate Usage (GAL)	Steam Plant C Natural Gas Usage (MSCF)	Steam Plant C Makeup Water Usage (GAL)
2000	1,946,880	584,551	188,727	65,659,832	7,114,143	14,225	1,450,534
2001	2,174,260	621,577	315,418	51,059,830	15,312,212	9,832	992,782
2002	2,132,888	603,318	26,307	49,901,000	14,235,526	9,621	1,191,103
2003	1,876,740	535,108	104,024	38,823,543	9,057,527	12,915	899,768
2004	1,813,247	559,747	1,617	38,279,600	8,753,807	5,400	491,454
2005	1,884,244	540,133	62,121	38,829,541	9,621,708	10,012	903,078
Average	1,971,377	574,072	116,369	47,092,224	10,682,487	10,334	988,120
Min	1,813,247	535,108	1,617	38,279,600	7,114,143	5,400	491,454
Max	2,174,260	621,577	315,418	65,659,832	15,312,212	14,225	1,450,534

Table J-2: Utility Usage by Test Cell

Fiscal year	16T AOH	16T TOTAL MWHs BILLED	16T TOTAL MWHs	16T H2O KGALs Billed	16T NAT GAS BILLED	16S AOH	16S TOTAL MWHs	16S TOTAL MWHs BILLED	16S H2O KGALs Billed	16S NAT GAS BILLED
2000	928.9	92599.7	94357.7	7202190	10295	0	0	0	0	0
2001	1127.88	108870.4	110481.9	7128780	6271	2.8	413.4	413.4	18624	140
2002	835.4	78473.9	80458.9	5034327	5180	44	1225.6	1225.6	57828	1920
2003	882.6	82364.6	85246.3	5893206	5732	9454.7	0	0	0	0
2004	473.6	39568.3	49793.1	2684832	3718	6125.8	757.3	757.3	112074	0
2004	640.74	55290.3	0	3910639	1874	0	0	0	0	0
Average	814.85333	76194.533	70056.317	5308995.7	5511.6667	2604.55	399.38333	399.38333	31421	343.33333
Min	473.6	39568.3	0	2684832	1874	0	0	0	0	0
Max	1127.88	108870.4	110481.9	7202190	10295	9454.7	1225.6	1225.6	112074	1920

Fiscal year	4T AOH	4T TOTAL MWHs	4T TOTAL MWHs BILLED	4T H2O KGALs Billed	4T NAT GAS BILLED	TUN A AOH	TUN A TOTAL MWHs	TUN A TOTAL MWHs BILLED	TUN A H2O KGALs Billed	TUN A NAT GAS BILLED
2000	0.6	6485.3	6485.3	440140	100	34.8	1367	1367	76080	280
2001	331.5	576.6	0	460922	884	126	5192	5192	203148	0
2002	13.6	15584.6	15584.6	1326630	1839	0	4061	4061	171796	340
2003	18	16577.4	16577.4	1304713	2877	0	512	512	49200	340
2004	0	7939.45	7939.45	788432	2376	0	2127.35	2127.35	169950	223
2004	1115.21	11323.7	0	931220	640	222.8	3363.2	0	325647	0
Average	246.485	9747.8417	7764.4583	875342.83	1452.6667	63.933333	2770.425	2209.8917	165970.17	197.16667
Min	0	576.6	0	440140	100	0	512	0	49200	0
Max	1115.21	16577.4	16577.4	1326630	2877	222.8	5192	5192	325647	340

Table J-2: (continued)

Fiscal year	TUN B					TUN C				
	AOH	TOTAL MWHs	TOTAL MWHs BILLED	H2O KGALs USED	NAT GAS BILLED	AOH	TOTAL MWHs	TOTAL MWHs BILLED	H2O KGALs Billed	NAT GAS BILLED
2000	71.6	4566	2084	128694	2032.1	0	0	0	0	0
2001	61	2295	2295	140466	1301	3	2104	2104	115938	1228
2002	0	2434	2434	155772	2405	0	0	0	0	0
2003	0	0	0	0	0	0	1231.5	1231.5	185808	850
2004	0	43.2	43.2	12060	74	0	5515.6	5515.6	511601	4182.14
2004	7	141.5	0	0	0	20.1	471.9	0	41400	360
Average	23.266667	1579.95	1142.7	72832	968.68333	3.85	1,554	1475.1833	142457.83	1103.3567
Min	0	0	0	0	0	0	-	0	0	0
Max	71.6	4566	2434	155772	2405	20.1	5,516	5515.6	511601	4182.14

Fiscal year	APTU				7V			Mark 1		
	AOH	TOTAL MWHs BILLED	H2O KGALs Billed	NAT GAS BILLED	TOTAL MWHs BILLED	H2O KGALs Billed	NAT GAS BILLED	TOTAL MWHs BILLED	H2O KGALs Billed	NAT GAS BILLED
2000	NA	0	0	0	0	0	0	0	0	0
2001	NA	0	0	0	0	0	0	0	0	0
2002	0	368	2680	0	106	0	0	2	0	0
2003	0	836	0	0	430.26	0	0	12.5	0	0
2004	0	0	0	0	681.9	0	0	0	0	0
2004	0	778	0	0	428	0	0	0	0	0
Average	0	495.5	670	0	411.54	0	0	3.625	0	0
Min	0	0	0	0	106	0	0	0	0	0
Max	0	836	2680	0	681.9	0	0	12.5	0	0

Table J-2: (continued)

Fiscal year	C1				C2			
	AOH	TOTAL MWHs BILLED	H2O KGALs Billed	NAT GAS BILLED	AOH	TOTAL MWHs BILLED	H2O KGALs Billed	NAT GAS BILLED
2000	NA	NA	NA	NA	NA	NA	NA	NA
2001	NA	NA	NA	NA	NA	NA	NA	NA
2002	0	8067	610349	0	0	18142	576792	0
2003	0	20414.8	1250058	0	0	0	0	0
2004	156.92	17386.9	1034550	0	285.99	95501.78	3158788.8	0
2004	106.26	16970	1178227	0	116.24	33946	1290724	0
Average	65.795	15709.675	1018296	0	100.5575	36897.445	1256576.2	0
Min	0	8067	610349	0	0	0	0	0
Max	156.92	20414.8	1250058	0	285.99	95501.78	3158788.8	0

Fiscal year	J1				J2			
	AOH	TOTAL MWHs BILLED	H2O KGALs Billed	NAT GAS BILLED	AOH	TOTAL MWHs BILLED	H2O KGALs Billed	NAT GAS BILLED
2000	NA	NA	NA	NA	NA	NA	NA	NA
2001	NA	NA	NA	NA	NA	NA	NA	NA
2002	0	4695	406158	3788	0	14400	1201426	918
2003	0	4987	384333	3987	0	8303	784396	2043
2004	170.8	14622.2	1764010	12224	158.99	27360.73	2944485.4	20111
2004	38.25	5616.5	613944	0	416.99	47045	3399540	16196
Average	52.2625	7480.175	792111.25	4999.75	143.995	24277.183	2082461.9	9817
Min	0	4695	384333	0	0	8303	784396	918
Max	170.8	14622.2	1764010	12224	416.99	47045	3399540	20111

Table J-2: (continued)

Fiscal year	J4				J6			
	AOH	TOTAL MWHs BILLED	H2O KGALs Billed	NAT GAS BILLED	AOH	TOTAL MWHs BILLED	H2O KGALs Billed	NAT GAS BILLED
2000	NA	0	0	0	NA	706	179526	0
2001	NA	378	76904	0	NA	313	69252	0
2002	0	110	24000	1100	0	190	63000	3300
2003	0	0	0	0	0	245	76404	18
2004	0	0	0	0	14.17	395.5	82932	5500
2004	0	0	0	0	21.08	501	131722	7734
Average	0	27.5	6000	275	8.8125	391.75	100472.67	4138
Min	0	0	0	0	0	190	63000	18
Max	0	110	24000	1100	21.08	706	179526	7734

Fiscal year	R!D				SL2			
	AOH	TOTAL MWHs BILLED	H2O KGALs Billed	NAT GAS BILLED	AOH	TOTAL MWHs BILLED	H2O KGALs Billed	NAT GAS BILLED
2000	NA	NA	NA	NA	NA	NA	NA	NA
2001	NA	NA	NA	NA	NA	NA	NA	NA
2002	0	0	0	0	0	794.62	176.42	791.4
2003	0	0	0	0	0	2786.5	2228	0
2004	0	0	0	0	0	1377	168471	0
2004	0	0	0	0	951.72	15872.5	1178829	42
Average	0	0	0	0	237.93	5207.655	337426.11	208.35
Min	0	0	0	0	0	794.62	176.42	0
Max	0	0	0	0	951.72	15872.5	1178829	791.4

Table J-2: (continued)

Fiscal year	SL3				T11			
	AOH	TOTAL MWHs BILLED	H2O KGALs Billed	NAT GAS BILLED	AOH	TOTAL MWHs BILLED	H2O KGALs Billed	NAT GAS BILLED
2000	NA	NA	NA	NA	NA	NA	NA	NA
2001	NA	NA	NA	NA	NA	NA	NA	NA
2002	0	3933	250590	0	0	1660	186678	855
2003	0	1689.5	12175	0	0	0	0	0
2004	0	0	0	0	0	0	0	0
2004	217.22	4664	309877	0	116.93	3398	423714	1533
Average	54.305	2571.625	143160.5	0	29.2325	1264.5	152598	597
Min	0	0	0	0	0	0	0	0
Max	217.22	4664	309877	0	116.93	3398	423714	1533
Fiscal year	**T3**				**T4**			
	AOH	**TOTAL MWHs BILLED**	**H2O KGALs Billed**	**NAT GAS BILLED**	**AOH**	**TOTAL MWHs BILLED**	**H2O KGALs Billed**	**NAT GAS BILLED**
2000	NA	NA	NA	NA	NA	NA	NA	NA
2001	NA	NA	NA	NA	NA	NA	NA	NA
2002	0	1010	53742	1012	0	9881	934926	3776
2003	0	478	16692	1655	0	16043.7	1536198	5553
2004	0	0	0	0	201.09	6017.7	780328	2591
2004	49.99	1284.3	96234	0	145.58	6791.5	583374	0
Average	12.4975	693.075	41667	666.75	86.6675	9683.475	958706.5	2980
Min	0	0	0	0	0	6017.7	583374	0
Max	49.99	1284.3	96234	1655	201.09	16043.7	1536198	5553

Table J-2: (continued)

Fiscal year	R1D Icing				R2A2 Tur			
	AOH	TOTAL MWHs BILLED	H2O KGALs Billed	NAT GAS BILLED	AOH	TOTAL MWHs BILLED	H2O KGALs Billed	NAT GAS BILLED
2000	NA	NA	NA	NA	NA	NA	NA	NA
2001	NA	NA	NA	NA	NA	NA	NA	NA
2002	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0
Min	0	0	0	0	0	0	0	0
Max	0	0	0	0	0	0	0	0

Fiscal year	A B Plant Ckots				C Plnt Ckots			
	AOH	TOTAL MWHs BILLED	H2O KGALs Billed	NAT GAS BILLED	AOH	TOTAL MWHs BILLED	H2O KGALs Billed	NAT GAS BILLED
2000	NA	NA	NA	NA	NA	NA	NA	NA
2001	NA	NA	NA	NA	NA	NA	NA	NA
2002	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0
2004	0	5406	427866	2364	0	1583	231660	0
2004	0	0	0	0	0	0	0	0
Average	0	1351.5	106966.5	591	0	395.75	57915	0
Min	0	0	0	0	0	0	0	0
Max	0	5406	427866	2364	0	1583	231660	0

Table J-2: (continued)

Fiscal year	H3 AOH	H3 TOTAL MWHs BILLED	H3 H2O KGALs Billed	H3 NAT GAS BILLED	H1 AOH	H1 TOTAL MWHs BILLED	H1 H2O KGALs Billed	H1 NAT GAS BILLED
2000	NA	NA	NA	NA	NA	NA	NA	NA
2001	NA	NA	NA	NA	NA	112	0	0
2002	0	28	700	0	0	116	5220	0
2003	0	50.5	0	0	0	80	0	0
2004	0	0	0	0	0	82	720	0
2004	0	32	0	0	0	15	0	0
Average	0	27.625	175	0	0	73.25	1485	0
Min	0	0	0	0	0	15	0	0
Max	0	50.5	700	0	0	116	5220	0

Fiscal year	H2 AOH	H2 TOTAL MWHs BILLED	H2 H2O KGALs Billed	H2 NAT GAS BILLED	ETF Plant AOH	ETF Plant TOTAL MWHs BILLED	ETF Plant H2O KGALs Billed	ETF Plant NAT GAS BILLED
2000	0	0	0	0	NA	NA	NA	NA
2001	0	0	0	0	NA	NA	NA	NA
2002	0	582.7	23334	0	0	0	0	0
2003	0	164.1	16950	0	0	0	0	0
2004	0	306	14770	0	0	0	0	0
2004	0	0	0	0	16.93	223.5	24714	0
Average	0	263.2	13763.5	0	4.2325	55.875	6178.5	0
Min	0	0	0	0	0	0	0	0
Max	0	582.7	23334	0	16.93	223.5	24714	0

APPENDIX K

Testing Fuel, Ground Fuel and Gases Usage
FY 2001-2005

Table K-1 Aviation Fuel Usage FY 2001 - 2005

FY 2001 Fuel Use			
Location	JP5 (gals)	JP8 (gals)	JPTS (gals)
Aircraft	--	1,883	--
A-Plant	--	--	--
ASTF	15,532	30,945	--
C1	--	214,258	--
C2	--	--	--
C-Plant	--	--	--
Fuel Farm	--	--	--
J1	--	--	--
J12 (MTSU)	--	--	--
J2	--	260,826	34,194
Maint	--	--	--
SL2	--	1,580,008	--
SL3	--	1,520,723	--
T1	--	25,920	--
T11	--	--	--
T4	--	48,159	--
Test Lab	--	--	--
Total	**15,532**	**3,682,722**	**34,194**

FY 2002 Fuel Use			
Location	JP5 (gals)	JP8 (gals)	JPTS (gals)
Aircraft	--	857	--
A-Plant	--	--	--
ASTF	--	12,349	--
C1	75,350	101,554	--
C2	--	9,959	--
C-Plant	--	2,425	--
Fuel Farm	--	--	--
J1	--	39,640	--
J12 (MTSU)	--	--	--
J2	--	116,443	--
Maint	--	--	--
SL2	--	1,659,787	--
SL3	--	483,302	--
T1	--	--	--
T11	--	--	--
T4	--	45,937	--
Test Lab	--	--	--
Total	**75,350**	**2,472,253**	**0**

FY 2003 Fuel Use			
Location	JP5 (gals)	JP8 (gals)	JPTS (gals)
Aircraft	--	747	--
A-Plant	--	--	--
ASTF	--	49	--
C1	--	221,442	--
C2	--	19,698	--
C-Plant	--	--	--
Fuel Farm	--	--	--
J1	--	54,537	--
J12 (MTSU)	--	--	--
J2	--	80,060	--
Maint	--	--	--
SL2	--	624,029	--
SL3	--	564,474	--
T1	--	--	--
T11	--	539	--
T4	--	131,983	--
Test Lab	--	--	--
Total	**0**	**1,697,558**	**0**

Table K-1: (continued)

FY 2004 Fuel Use					FY 2005 Fuel Use			
Location	JP5 (gals)	JP8 (gals)	JPTS (gals)		Location	JP5 (gals)	JP8 (gals)	JPTS (gals)
Aircraft	--	3,105	--		Aircraft	--	12,007	--
A-Plant	--	3,088	--		A-Plant	--	979	--
ASTF	--	--	--		ASTF	28,063	--	--
C1	--	140,797	--		C1	--	206,310	--
C2	--	181,275	--		C2	--	73,755	--
C-Plant	--	--	--		C-Plant	--	--	--
Fuel Farm	--	--	--		Fuel Farm	--	1,520	--
J1	--	136,347	--		J1	--	24,363	--
J12 (MTSU)	--	--	--		J12 (MTSU)	--	260	--
J2	--	221,390	--		J2	--	378,218	--
Maint	--	20	--		Maint	--	--	--
SL2	--	548,717	--		SL2	--	1,553,178	--
SL3	--	21,069	--		SL3	--	392,183	--
T1	--	--	--		T1	--	--	--
T11	--	--	--		T11	--	--	--
T4	--	11,291	--		T4	--	38,763	--
Test Lab	--	130	--		Test Lab	139	--	--
Total	**0**	**1,267,229**	**0**		**Total**	**28,202**	**2,681,536**	**0**

Table K-2: Ground Fuels Usage FY 2001-2005

FY 2001 Fuel Use

Location	Commingled (gals)	DL2	MUR
ASTF	--	--	NA
C1	45,448	--	NA
C2	11,653	--	NA
J1	--	--	NA
J2	942	--	NA
SL2	96,267	--	NA
SL3	--	--	NA
Steam Plant	--	351,895	NA
Auto Repair Sho	--	52,354	112,809
Total	**154,310**	**404,249**	**112,809**

FY 2002 Fuel Use

Location	Commingled	DL2	MUR
ASTF	29,257	--	NA
C1	30,003	--	NA
C2	--	--	NA
J1	--	--	NA
J2	--	--	NA
SL2	50,755	--	NA
SL3	6,830	--	NA
Steam Plant	--	7,539	NA
Auto Repair Sho	--	44,908	98,931
Total	**116,845**	**52,447**	**98,931**

FY 2003 Fuel Use

Location	Commingled (gals)	DL2	MUR
ASTF	--	--	NA
C1	55,200	--	NA
C2	--	--	NA
J1	--	--	NA
J2	--	--	NA
SL2	--	--	NA
SL3	--	--	NA
Steam Plant	--	135,500	NA
Auto Repair Sho	--	59,908	107,445
Total	**55,200**	**195,408**	**107,445**

FY 2004 Fuel Use

Location	Commingled	DL2	MUR
ASTF	21,268	--	NA
C1	41,301	--	NA
C2	--	--	NA
J1	--	--	NA
J2	--	--	NA
SL2	11,806	--	NA
SL3	--	--	NA
Steam Plant	--	0	NA
Auto Repair Sho	--	44,848	107,310
Total	**74,375**	**44,848**	**107,310**

FY 2005 Fuel Use

Location	Commingled (gals)	DL2	MUR
ASTF	--	--	NA
C1	62,817	--	NA
C2	8,340	--	NA
J1	--	--	NA
J2	--	--	NA
SL2	65,444	--	NA
SL3	46,697	--	NA
Steam Plant	--	45,052	NA
Auto Repair Sho	--	32,856	89,082
Total	**183,298**	**77,908**	**89,082**